PENCIL POINTS

SEPTEMBER
1939

World's LARGEST HOUSING PROJECT *... uses Tons of* NATIONAL PIPE

Architect's conception of one section of Parkchester, important housing project now under construction in the Bronx, New York City. Of the many tons of pipe to be used in this project, the bulk will be NATIONAL *Pipe, selected because of its long record of successful applications. Board of Design: R. H. Shreve, Chairman; H. C. Meyer, Jr.; G. D. Clarke; Irwin Clavan; A. J. Eken; George Gove; Robert W. Dowling, New York. Engineers: Meyer, Strong and Jones; Purdy and Henderson; Burns and Roe, New York. General Contractors: Starrett Bros. & Eken, Inc. Heating Contractors: Baker, Smith & Company, Inc.*

(Below) Work is progressing at a rapid rate at Parkchester, with first buildings scheduled for occupancy early in 1940. NATIONAL *Pipe is used extensively throughout this project, because it is widely recognized as a clean, strong, thoroughly uniform pipe of low cost.*

PARKCHESTER, Metropolitan's new record-breaking housing project, is worth watching. For besides being far the largest of its kind, it offers facilities which have heretofore never been available in moderate-rental housing.

Designed to house 42,000 people, the project will consist of 51 buildings, some scheduled for completion early in 1940. It will occupy 129 acres of the Bronx, New York City, and includes a full complement of stores, a theater, and garages. In addition, provision has been made for parks, shaded walks and malls, playgrounds, wading pools, roller skating paths, handball and softball courts, and other recreational facilities.

Buildings will be of fireproof construction, modern in every detail. In keeping with the general character of the project, only finest quality materials have been approved. That is why, of all the pipe to be used in this gigantic undertaking, the major tonnage will be NATIONAL Pipe.

Here, as in other famous commercial, public, and residential building projects, NATIONAL Pipe was the choice of architects and builders, because in all-round building applications it gives more service per dollar of cost than any other type of pipe.

NATIONAL TUBE COMPANY

PITTSBURGH, PA.

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

VOLUME XX NUMBER 11 NOVEMBER 1939

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PENCIL POINTS

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Gentlemen, we give you the Tennessee Valley Authority! We have devoted this issue to the TVA, not because it is engaged in what has been truly described as a far-reaching social experiment, not because it is efficiently carrying out a magnificent engineering undertaking, not even because it represents the largest regional planning enterprise in our country's history—but because it has built and is building an extensive and varied series of structures that embody a consistent and admirable architectural philosophy. While pictures are never a wholly satisfactory substitute for reality, we believe that from the following pages there may be gained a fairly good idea of the TVA architecture and an appreciation of its functional and æsthetic qualities. We have chosen to treat it in detail since a good part of its merit derives from the skill and judgment its designers showed in the selection, disposition, and articulation of materials. It was all designed under the leadership of Roland A. Wank, *Principal Architect;* Harry B. Tour, *Senior Architect;* and their assistants, Mario Bianculli and Hiram Ostrander. These men work under the direction of Theodore B. Parker, *TVA Chief Engineer,* and Earle S. Draper, *Director of Regional Planning Studies of the TVA.* We are indebted for the major portion of the photographs reproduced herewith to Charles Krutch, Photographer and Chief of the Graphic Arts Service of the TVA. A number of photographs were obtained from the Photographic and Reproduction Section, while a few were privately taken by employees of the Authority. We thank them, one and all!

PICKWICK LANDING DAM, DOWNSTREAM, LOOKING TOWARD POWERHOUSE

DESIGN IN TVA STRVCTVRES

BY KENNETH REID

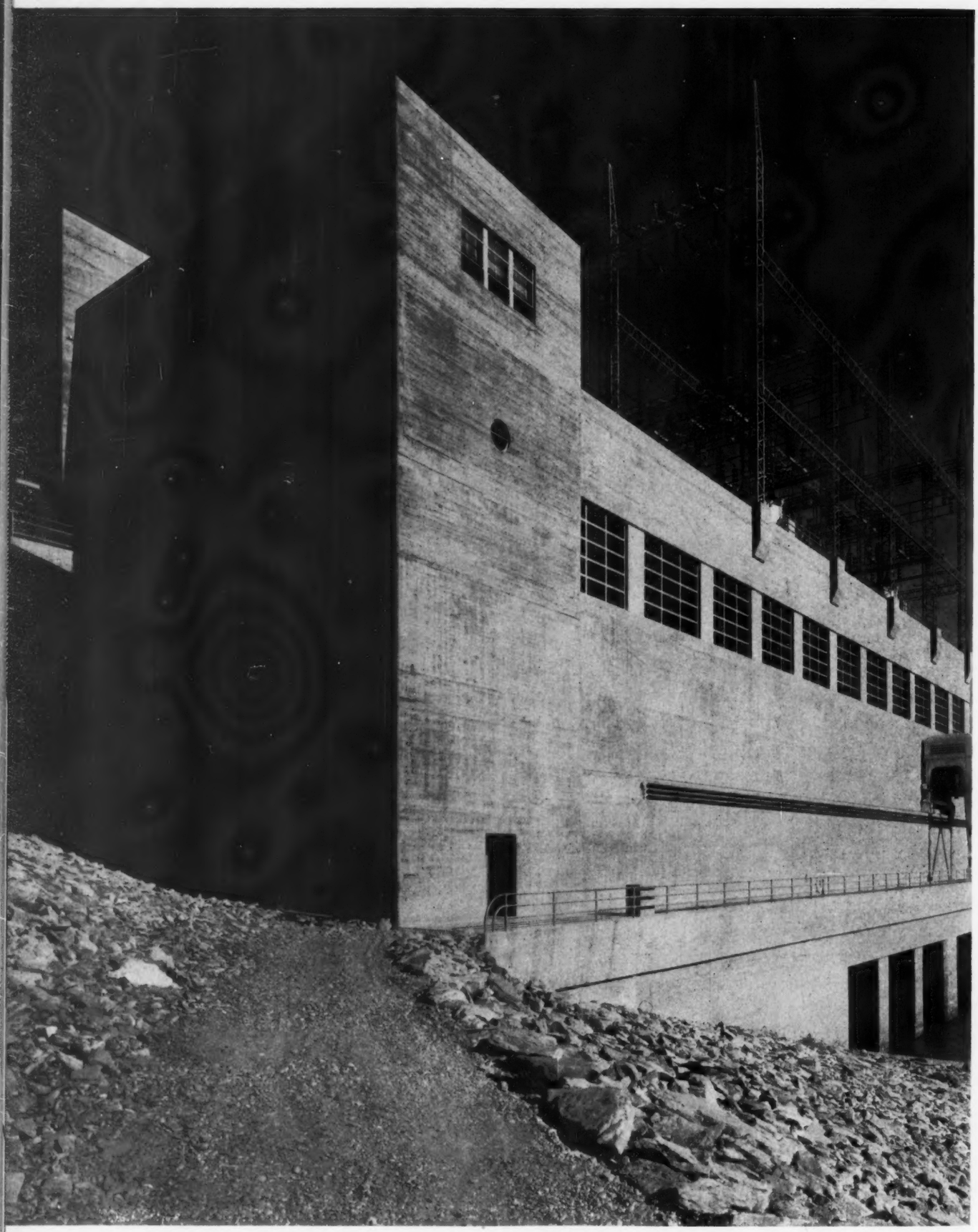
There are perhaps two phases in the design of any serious work of architecture. The first is the general conception which culminates in the fixing of the plan and the definition of masses. During this phase the architectural genius displays his brilliance, his logic, his feeling for form and proportion. One mind usually takes the responsibility here and deserves all credit.

There follows another phase, less spectacular but no less vital—the design of detail and its articulation. The ultimate success of the whole depends in large part upon the taste, the skill, the ingenuity with which the designers and detailers develop the elements out of which the building is to be compounded and devise the ways in which they are to be put together. In this work the functional and the æsthetic must be nicely blended, the practical must become the full partner of the beautiful. Where this desirable marriage is accomplished, the result is likely to be a true work of architecture. And, between ourselves, the process itself is more than likely to have been a collaboration, whether acknowledged or not, among a number of individuals, each of whom has applied creative thought to solving some part of the problem.

It is this aspect of the TVA design that has particularly interested and impressed me. Behind the finished work lies an admirably composed and closely integrated organization of architectural and engineering workers, all of whom, behind excellent leadership, have shared in the development of the unusual assemblage of buildings illustrated hereafter.

The Norris Dam and Powerhouse have been already presented in another magazine rather completely; hence they are not included here. The general scheme of the TVA as a great regional development has also been ably published elsewhere. We have felt, however, that the principal lesson for the average architect lies in the details—in the way true economy and substantial construction requirements have been reflected in the choice and combination of materials, all touched with the magic of orderly disposition and harmonious form and color. There is a consistent logic and sensibility running through all these structures, small as well as great. Everywhere the arrangements are adjusted to the human being, not only as a worker in and user of buildings and accessories, but also as one who sees and feels and enjoys. The observant designer, as he turns the following pages, will find many ideas that are worth incorporating in his own work. That way progress lies!

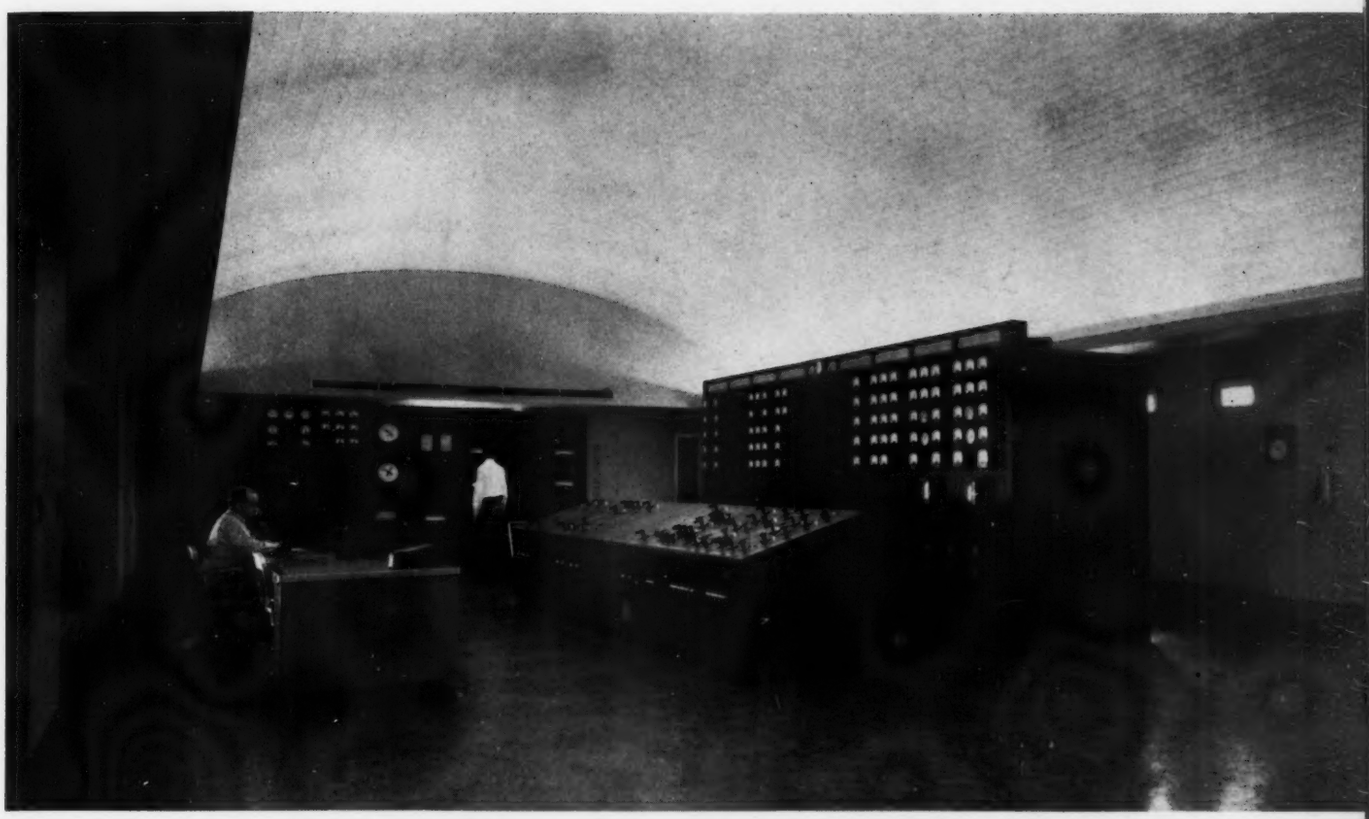
MASSIVE END OF SPILLWAY SECTION AT PICKWICK LANDING DAM, AT INTERSECTION WITH NAVIGATION LOCK. PYLONS HOUSE BUMPERS FOR GANTRY CRANE ON SPILLWAY DECK AND WOULD TRANSMIT STRESSES TO BULK CONCRETE BELOW IN CASE OF COLLISION. STAIRS USED BY VISITORS AND OPERATORS LIGHTED BY COUNTERSUNK CONTROL LENS UNITS. ALUMINUM AND OPAL GLASS FIXTURES ON PYLONS PROVIDE FOR GENERAL LIGHTING



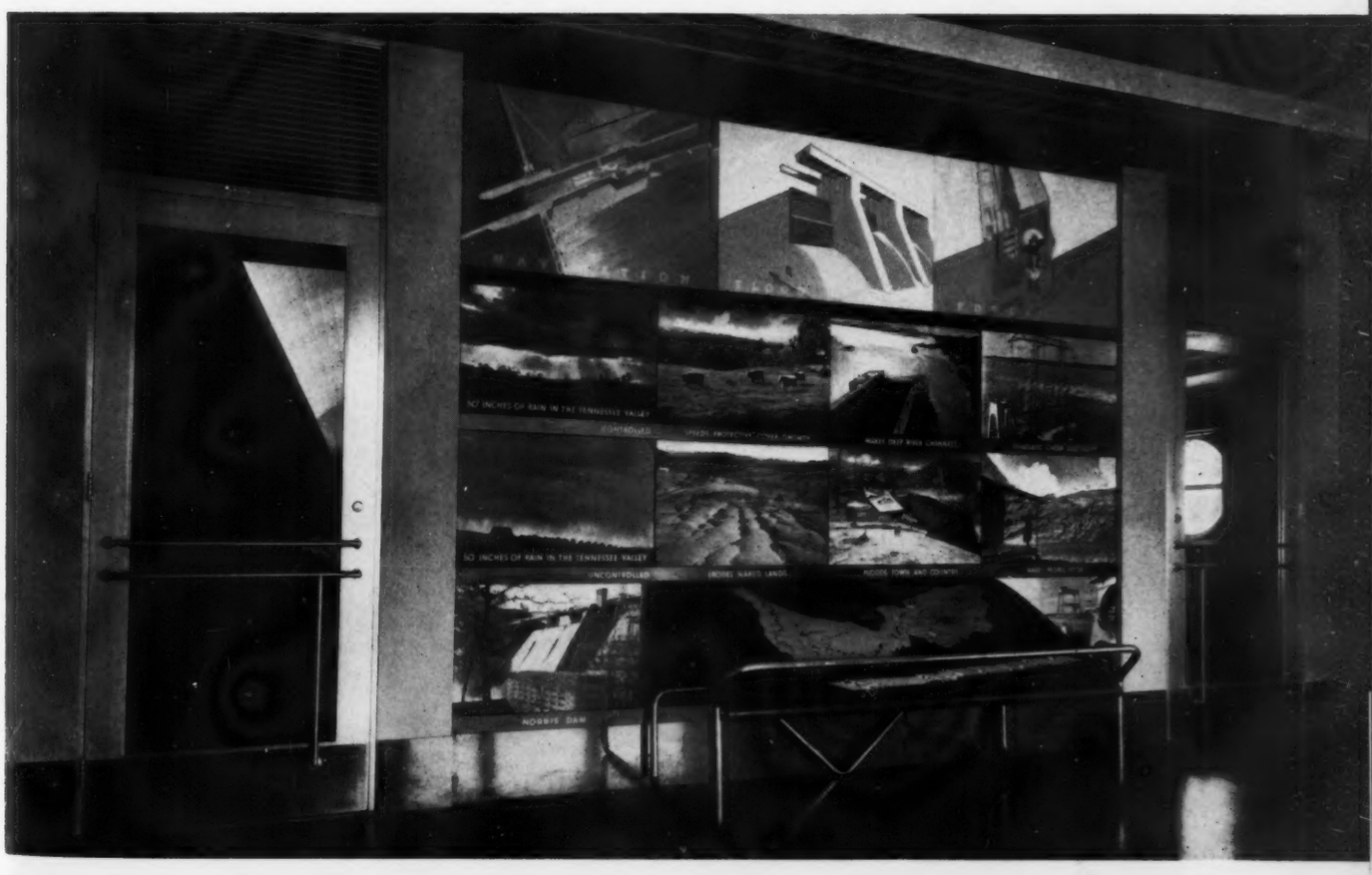
HERE AND OPPOSITE ARE EXTERIOR AND INTERIOR VIEWS OF THE PICKWICK LANDING POWER-HOUSE AS IT IS TODAY. THE ULTIMATE LENGTH, WHEN FUTURE GENERATOR UNITS ARE ADDED, WILL BE ABOUT THREE TIMES AS GREAT. THE CONCRETE ON THIS JOB WAS FORMED WITH DRESSED LUMBER. PIERS BETWEEN GENERATOR ROOM WINDOWS ARE STEEL, PAINTED GRAY

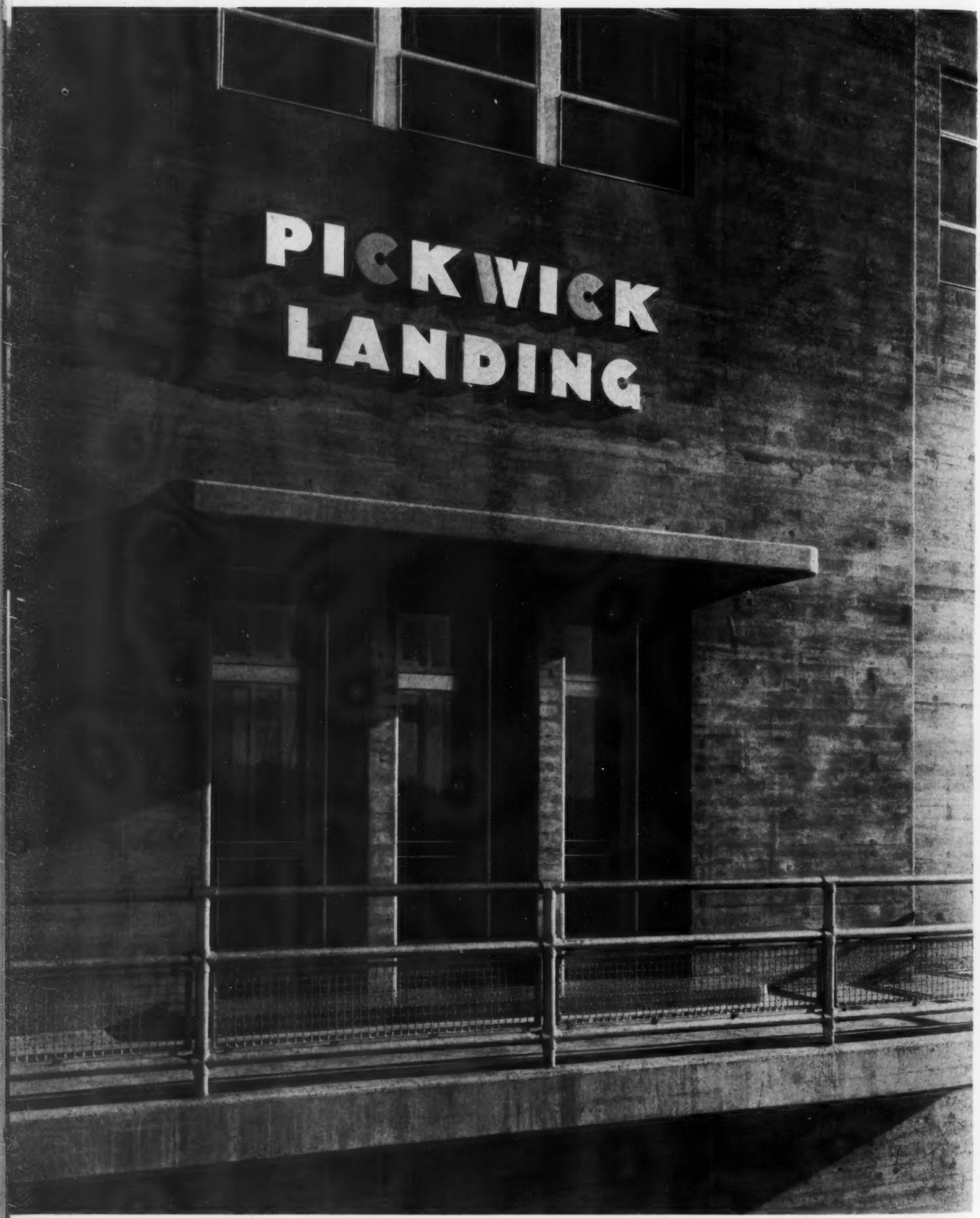
THE GENERATOR ROOM FLOOR AT PICKWICK IS FRENCH GRAY CERAMIC TILE; THE WAINSCOT, EGGSHELL-GLOSS GLAZED TILE OF A GRAY-BLUE-GREEN COLOR. CONCRETE ABOVE WAINSCOT IS PAINTED A LIGHTER SHADE OF THE SAME COLOR TO THE CRANE RAIL LEVEL, THENCE LIGHT SULFUR YELLOW TO THE TOP. TRUSSES AND ROOF PAINTED GRAY, WINDOW PIERS ALUMINUM

NORTH VIEW OF PICKWICK POWERHOUSE TAKEN FROM TOP OF DAM. BELOW IS RECEPTION LOBBY AS SEEN FROM INSIDE ENTRANCE DOORS. REDDISH BROWN AND WHITE TERRAZZO FLOORS WITH RED-BROWN BASE AND BURLAP-COVERED WALLS PAINTED GRAY ARE BRIGHTENED BY BLUE SOFFITS AND LEMON YELLOW PLASTER CEILING. ALUMINUM FURNITURE, UPHOLSTERED BLUE, AND ALUMINUM DOORS FURNISH SHARPER ACCENTS IN THIS ORDERLY ENSEMBLE



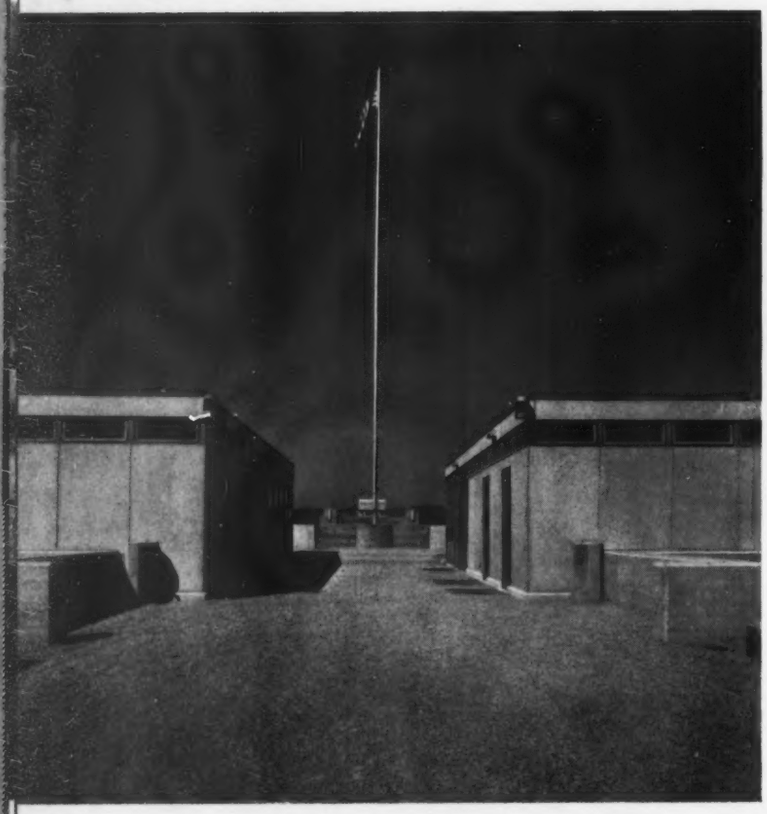
PICKWICK CONTROL ROOM, WITH PERFORATED ACOUSTIC INSULATION TILE PAINTED WHITE TO REFLECT COVE LIGHTING SO ARRANGED AS TO MINIMIZE GLARE AND MAKE INSTRUMENT READING EASY. BELOW IS THE DISPLAY JUST OUTSIDE, IN THE RECEPTION LOBBY, WHERE GUIDES USE IT TO EXPLAIN THE TVA AND ITS FUNCTIONS TO VISITORS. NOTE THE MAP TABLE OF CHROME PLATED TUBING AND BENT PLYWOOD UPON WHICH IS PRESENTED THE REGION





THE MAIN ENTRANCE ON THE NORTH END OF THE PICKWICK LANDING POWERHOUSE IS A FINE EXAMPLE OF STRONG SIMPLE DETAIL FOR A CONCRETE BUILDING. THE DOORS, FRAMES, AND LETTERING ARE OF ALUMINUM. FLUSH CONTROL LENS FIXTURES UNDER THE CANOPY FURNISH NIGHT LIGHT FOR THIS ENTRANCE. DRESSED LUMBER FORM BOARDS WERE USED

FROM THE FLOOR OF THE GENERATOR ROOM AT PICKWICK, LOOKING UP AT THE VISITORS' OBSERVATION GALLERY OUTSIDE THE CONTROL ROOM WINDOWS. GALLERY LEVEL IS BELOW THAT OF CONTROL ROOM FLOOR TO PERMIT CLEAR VIEW TO OPERATORS. THE ALUMINUM STAIR RAIL IS WELL PROPORTIONED AND STRONGLY CONSTRUCTED. COMPARE WITH PAGE 720

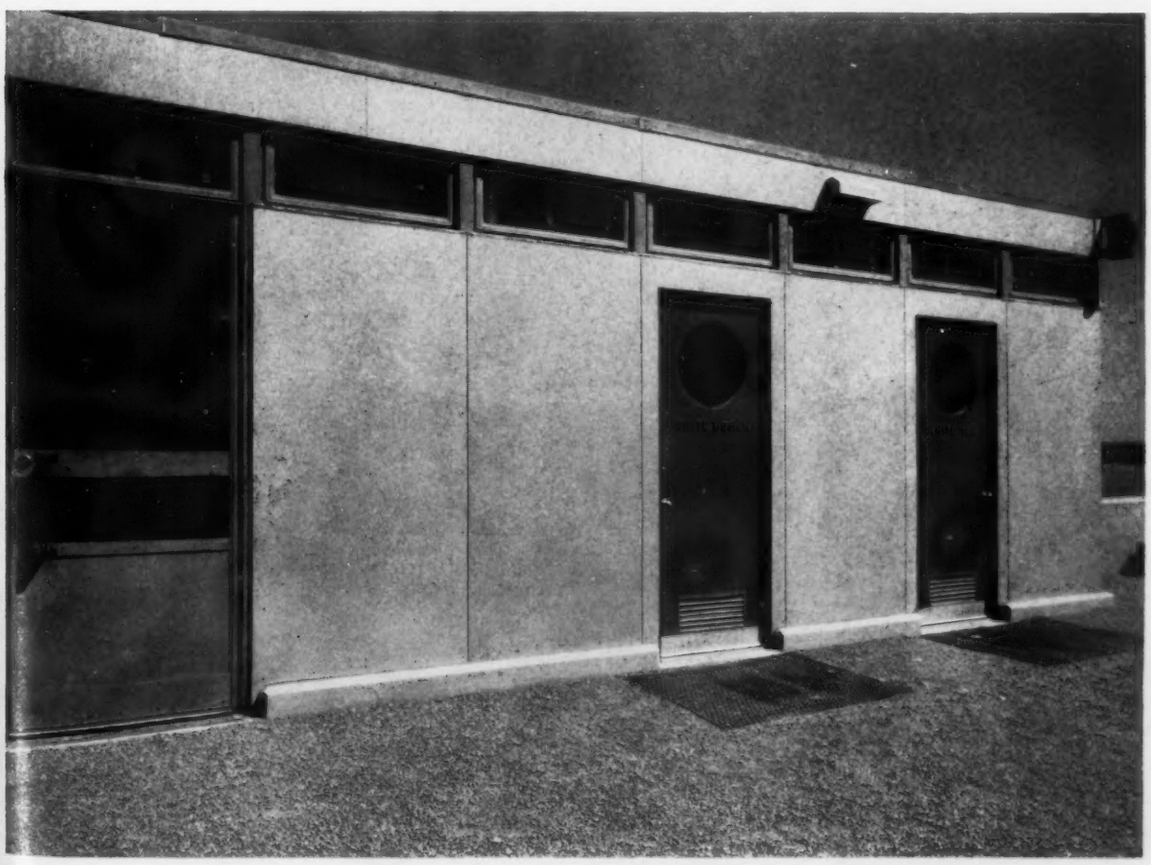


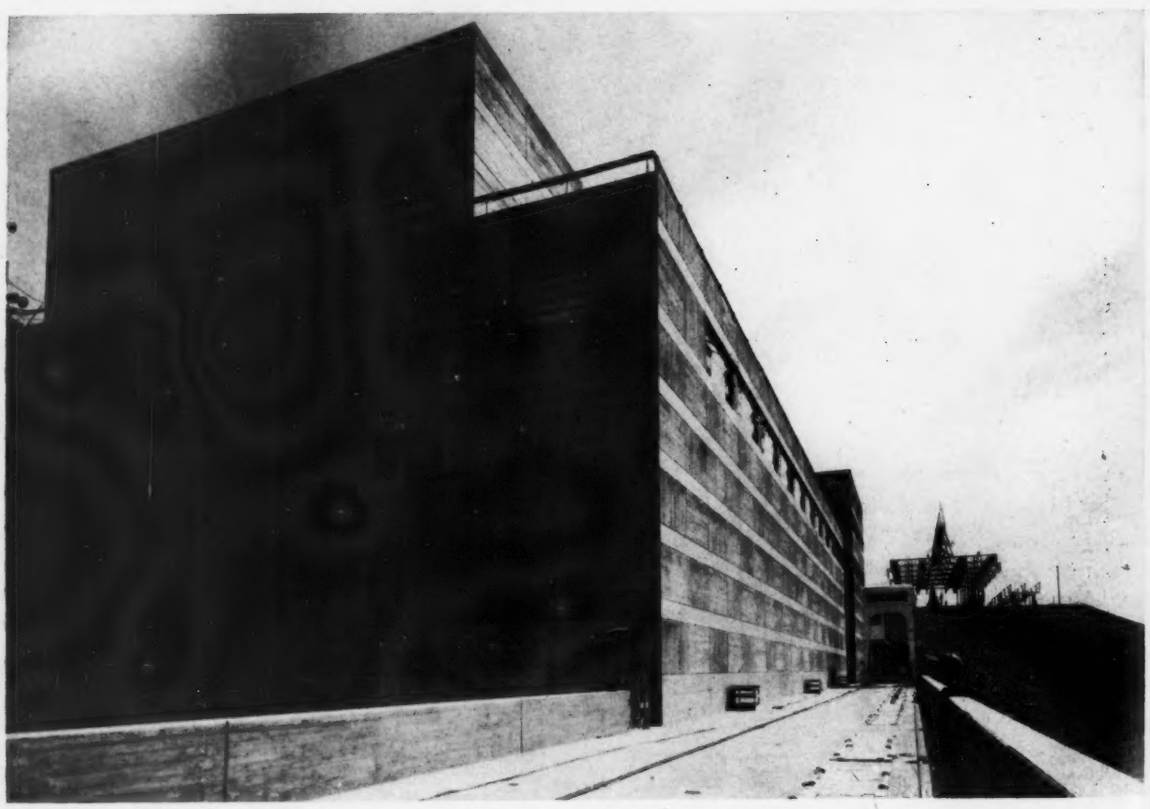
TWO VERY INTERESTING LITTLE BUILDINGS ARE PLACED AT THE END OF PICKWICK LANDING'S EARTH DIKE ADJACENT TO THE NAVIGATION LOCK. SEPARATED TO PERMIT EMERGENCY HAULING OF MACHINERY, THEY FLANK THE ROADWAY TO FORM RECEPTION CONVENIENCES FOR VISITORS. THEY CONTAIN A RECEPTION ROOM WITH DISPLAYS, A REFRESHMENT STAND, STORAGE SPACE, AND TOILETS. THE VIEW AT THE LEFT LOOKS BETWEEN THE BUILDINGS, ACROSS THE LOCK TOWARDS THE DAM AND POWERHOUSE. BELOW IS WHAT IS SEEN LOOKING AWAY FROM THE DAM FROM THE SPILLWAY LEVEL ON TOP OF THE CONSTRUCTION SHOWN ON THE FRONTISPIECE. FROM THE OBSERVATION END OF THE RECEPTION ROOM, THE VISITOR GETS A VIEW OF THE LOCK AND WHEN THERE ARE BOATS OR BARGES GOING THROUGH CAN SEE THE ENTIRE OPERATION. IN GOOD WEATHER HE CAN VIEW THE PROCEDURE FROM THE TERRACE OUTSIDE. STAIRS LEAD FROM EITHER SIDE DOWN TO THE LOCK LEVEL. NOTE THE STEEL FLAGPOLE

TWO OTHER VIEWS OF THE RECEPTION BUILDINGS SHOW ONE OF THE TERRACES AND THEIR RELATION TO THE RIP-RAP COVERED EARTH DIKE. IT WILL BE NOTED THAT THE WALLS ARE MADE IN PANELS OF UNIFORM WIDTH. THE WHOLE CONSTRUCTION IS BASED ON A MODULE OF 40″. THE FRAMING IS OF WOOD STUDS, 3″ x 3″, WHICH ARE COVERED WITH QUARTER-INCH STEEL PLATE WHERE EXPOSED BETWEEN TOILET VENT SASH. IN THE OBSERVATION ROOMS, STEEL MULLIONS MADE OF TWO 3″ CHANNELS WELDED FULL LENGTH TAKE THE PLACE OF THE STUDS. THE OUTSIDE WALL COVERING IS 3/8″ ASBESTOS-CEMENT BOARD, HELD BY PLATED COUNTER-SUNK SCREWS, PULLED UP TIGHT AGAINST 3″ STRIPS OF HEAVY ASPHALT FELT UNDER JOINTS FOR WEATHERPROOFING. THE JOINTS ARE CHAMFERED. SPACING OF WOOD STUDS AND ROOF JOISTS IS 20″ ON CENTERS. THE ROOF IS BUILT-UP, WITH LEAD-COVERED COPPER FOR GRAVEL STRIP AND COPING. THE OBSERVATION PORTIONS HAVE STEEL SASH GLAZED WITH PLATE GLASS

ON THE INTERIOR OF THE PICKWICK LANDING RECEPTION BUILDINGS THE WALLS ARE FINISHED WITH 40″ WIDE SHEETS OF 3/16″ STEEL-PRESSED, FLEXIBLE, ASBESTOS BOARD OF A MEDIUM GRAY COLOR. THE DISPLAY PANEL IS OF ¼″ PLYWOOD, PAINTED LEMON YELLOW. CEILINGS, LIKEWISE PAINTED LEMON YELLOW, ARE PLYWOOD, V-JOINTED IN 40″ SQUARES

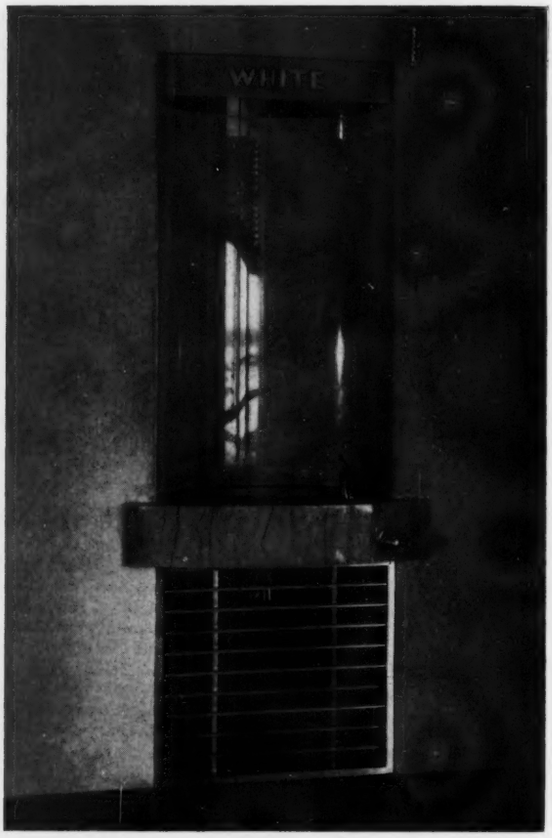
CLOSE-UPS OF THE EXTERIOR SHOW THE CONSTRUCTION CLEARLY. NOTE THAT THERE IS A LARGE PANE IN EACH WINDOW AT VIEW HEIGHT WITH TOP PANES THAT SWING OUT AND BOTTOM PANES THAT SWING IN. ALL VENT SASH ARE SCREENED. TOILET INTERIORS ARE TREATED WITH STEEL-PRESSED, FLEXIBLE, ASBESTOS BOARD FOR WALLS AND STOCK STEEL PARTITIONS

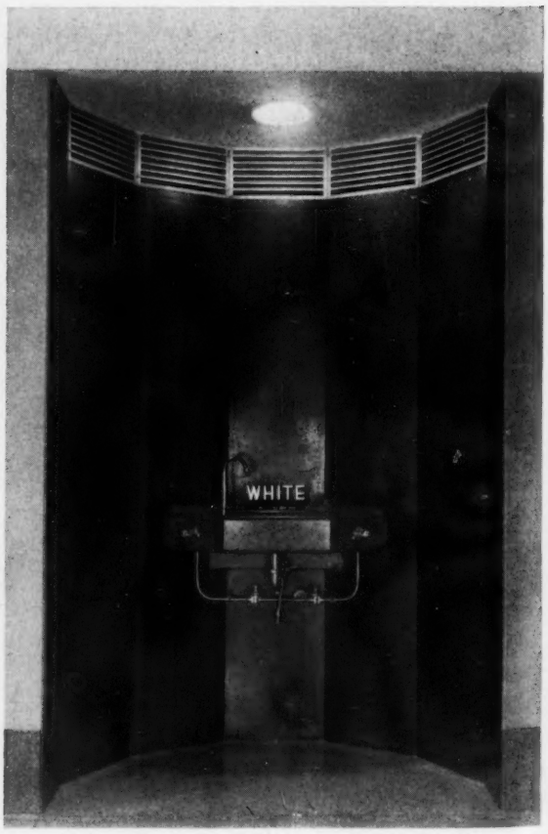




THE EXTERIOR OF CHICKAMAUGA POWERHOUSE, STILL UNDER CONSTRUCTION, SHOWS AN IMPROVED TREATMENT FOR THE CONCRETE SURFACE. THE VIEW ABOVE SHOWS THE SIDE OF THE GENERATOR HALL AS VIEWED FROM THE ROOF OF THE "SET-BACK" IN THE LOWER PICTURE. GLASS BRICK WAS USED TO ADMIT LIGHT AND REDUCE HEAT. COLUMNS PAINTED ALUMINUM

ALTERNATING FORM PANELS OF VERTICAL AND HORIZONTAL ROUGH-SAWN BOARDS WERE USED HERE AS AT NORRIS, BUT WITH NARROWER PANELS OF PLYWOOD TO GET BANDS OF SMOOTH SURFACE BETWEEN. THIS PRODUCES AN INTERESTING PLAY OF LIGHT. THIS VIEW SHOWS THE ADMINISTRATION WING. NARROW TOP OPENINGS WILL BE LOUVERED FOR AIR CONDITIONING



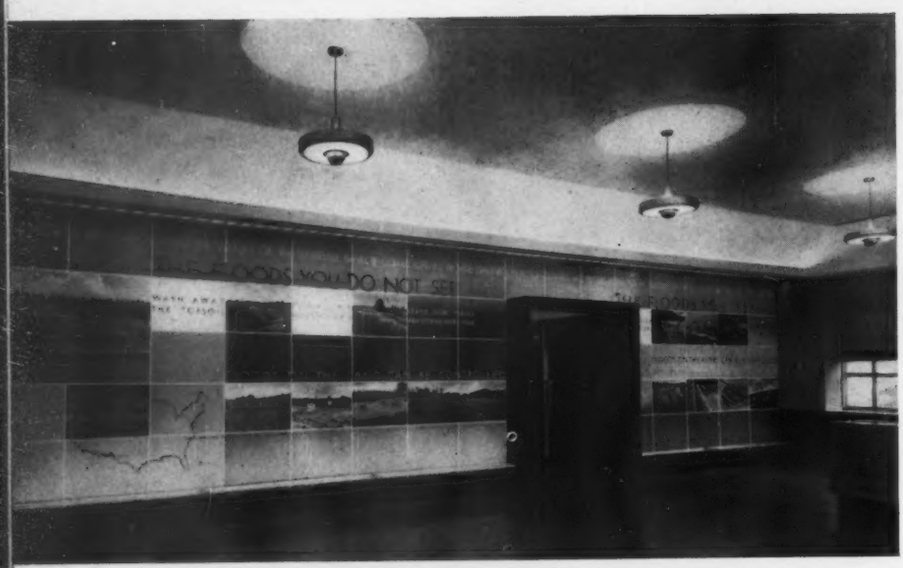


THE CLEAN, EFFICIENT-LOOKING DETAILS THAT ARE USED IN ALL THE TVA BUILDINGS ARE THE RESULT OF CAREFUL STUDY. THEIR ELEMENTS ARE SIMPLIFIED AND, WHERE POSSIBLE, STANDARDIZED. THE RESULT IS A FEELING OF EXTREME ORDERLINESS. SUBSTANTIAL MATERIALS —ALUMINUM, TERRAZZO, MARBLE—BESPEAK THE PERMANENT NATURE OF THE BUILDINGS

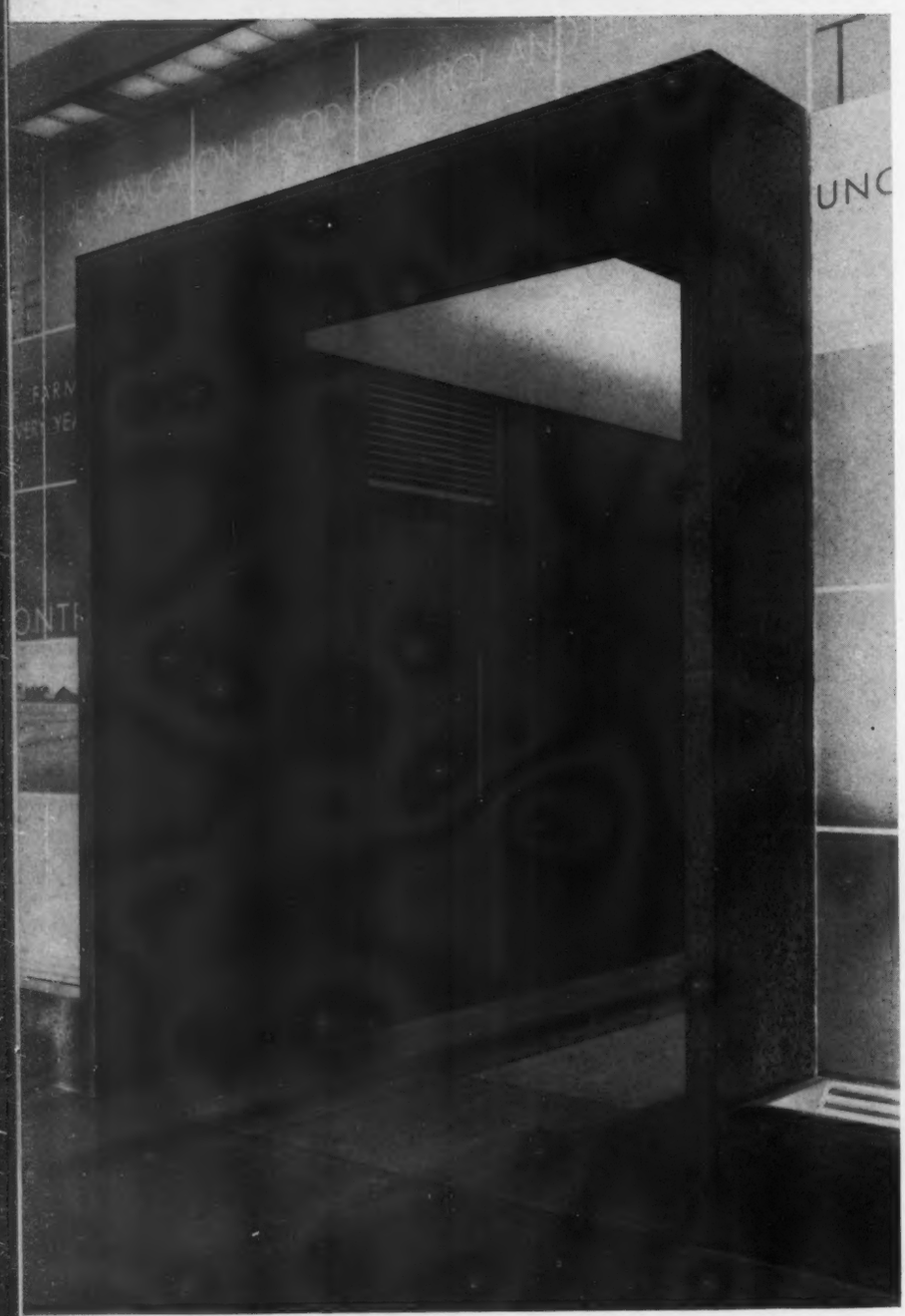
THE NORTH (ABOVE) AND WEST (OPPOSITE, BELOW) SIDES OF THE WHEELER CONTROL BUILDING SHOW THE HIGH FOLDING ALUMINUM DOORS THROUGH WHICH LARGE TRANSFORMERS AND GENERATOR PARTS MAY PASS INTO THE REPAIR SPACES. CONCRETE HERE IS FORMED WITH DRESSED BOARDS, PAINTED WITH CEMENT GROUT AFTER STRIPPING FORMS, THEN RUBBED

AT WHEELER, THE OFFICE RECEPTION ROOM HAS A RED RUBBER TILE FLOOR, A STEEL BASE PAINTED GRAYISH BLUE, NATURAL OAK FLEXWOOD WAINSCOT, ALUMINUM DOORBUCKS AND HARDWARE, LIGHT GRAY ENAMEL DOOR PANELS, AND A PAN-SHAPED LIGHTING DOME IN ACOUSTIC PLASTER PAINTED LEMON YELLOW

LOBBY ON LOWER FLOOR OF WHEELER, WHERE VISITORS REENTER BUILDING AFTER TOUR OF PLANT. LIGHT FIXTURES CONTAIN FIVE BULBS WITH FILAMENTS CENTERED IN CYLINDERS. FLOOR AND BASE, LIGHT GRAY TERRAZZO. PATH TO ELEVATOR, WHITE WITH YELLOW EDGE. CEILING, CANARY YELLOW



THE RECEPTION ROOM ON THE UPPER OR ENTRANCE FLOOR AT WHEELER IS DECORATED BY A HANDSOME DISPLAY OF PHOTO PRINTS MOUNTED DIRECTLY ON THE PLASTER AND KEYED IN COLOR TO THE WARM TAN OF THE BURLAP WAINSCOT. THE BASE AND LOWER PART OF THE WAINSCOT ARE REDDISH BROWN PRECAST TERRAZZO. FLOORS ARE GRAY TERRAZZO AND THE ACOUSTIC PLASTER CEILING IS PAINTED A WARM LIGHT GRAY EXCEPT FOR THE REFLECTING CIRCLES WHICH ARE SLIGHTLY OFF WHITE

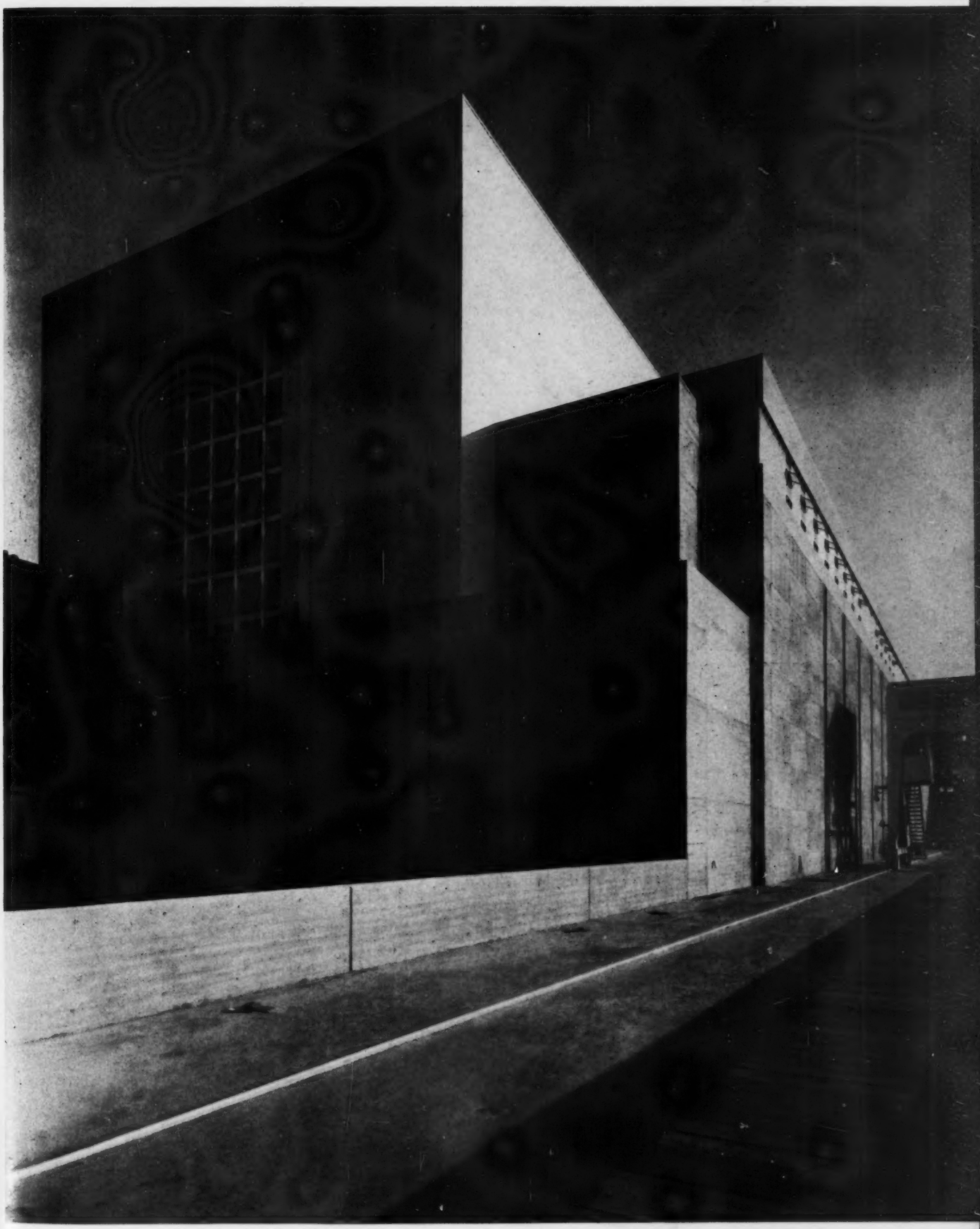


ILLUMINATION OF DISPLAY IS ACCOMPLISHED BY TWO ROWS OF CONTROL LENS FIXTURES, TOP AND BOTTOM. THESE ARE WIRED IN SEVERAL CIRCUITS SO THAT DIFFERENT INTENSITIES CAN BE HAD. THE BOTTOM TROUGH, WHICH ALSO SERVES AS THE AIR EXHAUST, IS NEATLY TIED IN TO THE DOOR ENFRAMEMENT, INCIDENTALLY GIVING A GOOD DEEP REVEAL. THE AIR SUPPLY IS AT THE CEILING END. ALL METAL IN THIS ROOM IS ALUMINUM, INCLUDING THE HANDSOME DOORS WHICH HAVE A SATIN FINISH

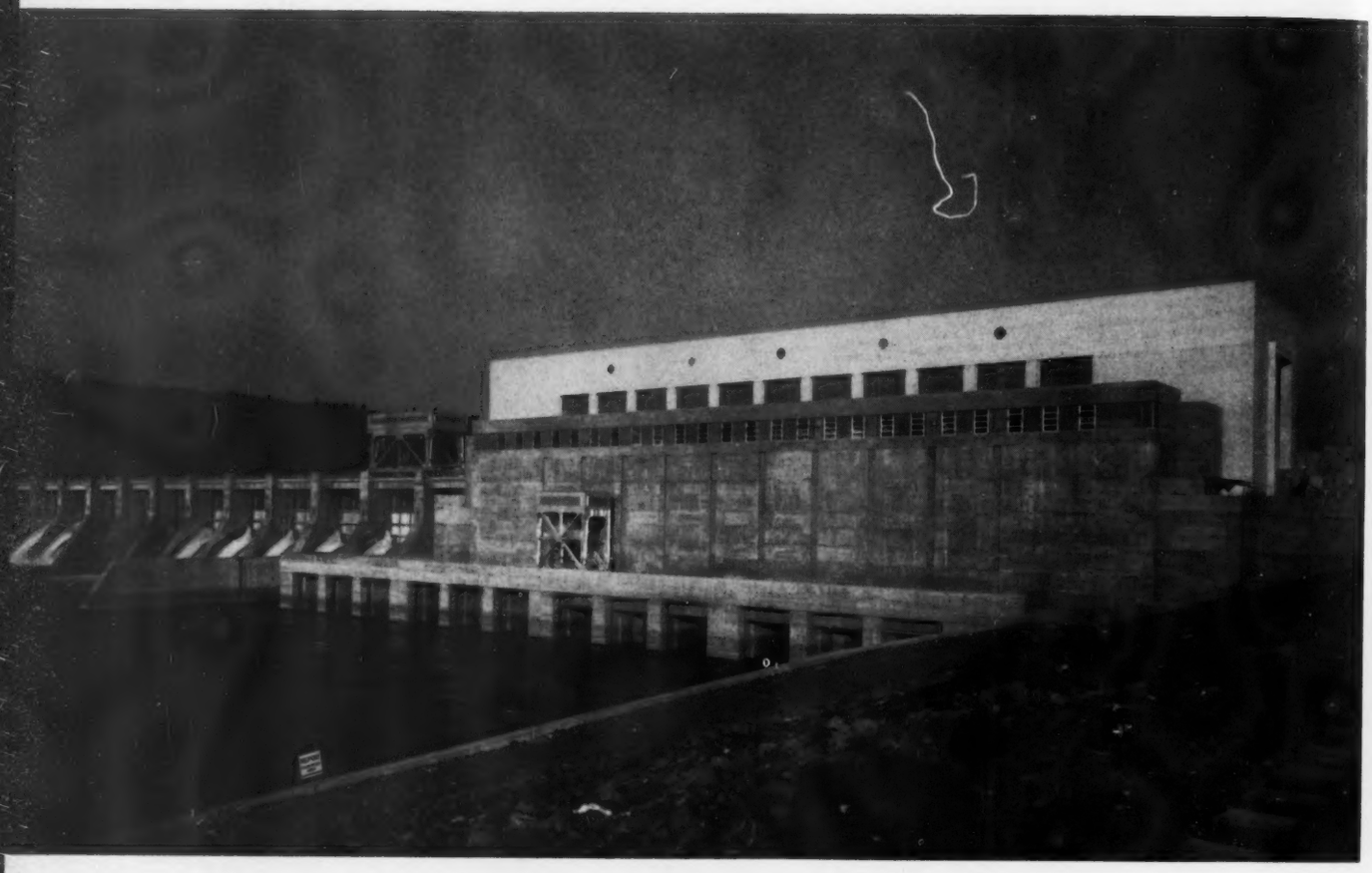
THE CORRIDOR OFF THE RECEPTION ROOM HAS PAINTED BURLAP WALLS AND A SEMICIRCULAR VAULTED CEILING WHOSE SURFACE IS ACOUSTIC PLASTER, PAINTED A RICH OCHRE. A TROUGH FIXTURE IN SATIN FINISH ALUMINUM THROWS THE LIGHT UPWARD TO BE SO WELL DIFFUSED THAT THE FORM OF THE VAULT IS LOST. THIS VIEW LOOKS THROUGH THE RECEPTION ROOM OUT ONTO THE VISITORS' OVERLOOK TERRACE ON THE ROOF AT THE RIGHT SIDE OF THE ILLUSTRATION ON PAGE 707. NOTE MAP TABLE

THE MAIN ENTRANCE LOBBY ON THE SAME LEVEL AS THE RECEPTION ROOM HAS AN INTERESTING LIGHT-FIXTURE MADE OF SATIN FINISH ALUMINUM AND REFLECTING INTO AN ELLIPTICAL DOME. FOUR CIRCUITS OF INCANDESCENT BULBS PERMIT VARIOUS DEGREES OF BRILLIANCE. THE PLATE GLASS WINDOWS AT THE RIGHT GIVE A CLEAR VIEW INTO THE CONTROL ROOM. A DETAIL SHOWING HOW THE GLASS IS HELD IN PLACE WITH A CONCEALED ALUMINUM FRAME WILL BE FOUND FURTHER ON IN THE ISSUE

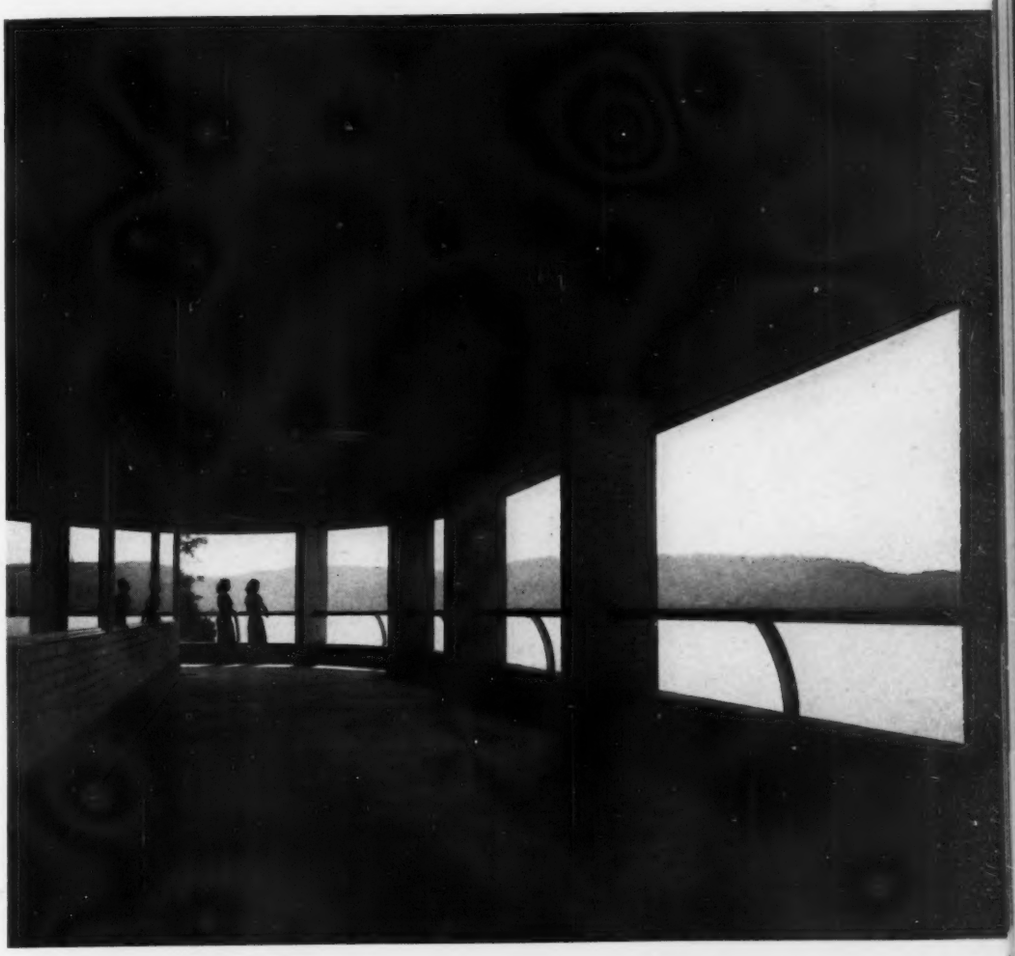
DOWNSTREAM SIDE OF GUNTERSVILLE POWERHOUSE. THE UPPER PART OF THE GENERATOR HALL WAS HERE BUILT OF BRICK SINCE THERE IS NO POSSIBILITY OF THE TAILWATER RISING FAR ENOUGH TO REACH THIS PORTION. THE CONCRETE WALLS SHOWN HERE ARE VERY THICK, TO PROVIDE SUFFICIENT WEIGHT TO KEEP BUILDING FROM FLOATING OFF IN HIGH WATER



THE GUNTERSVILLE POWERHOUSE IS STILL UNDER CONSTRUCTION. THE GRAYISH BUFF BRICK GENERATOR HALL WITH ITS MAGNIFICENTLY SCALED END WINDOW CONTRASTS WITH THE CONCRETE OF THE ELECTRICAL AND OFFICE BAY. STAIRS IN THE LOW CUBICLES ARE LIGHTED WITH GLASS BRICK. ALTERNATE WINDOWS AND GLASS BRICK PANELS LIGHT ROW OF OFFICES

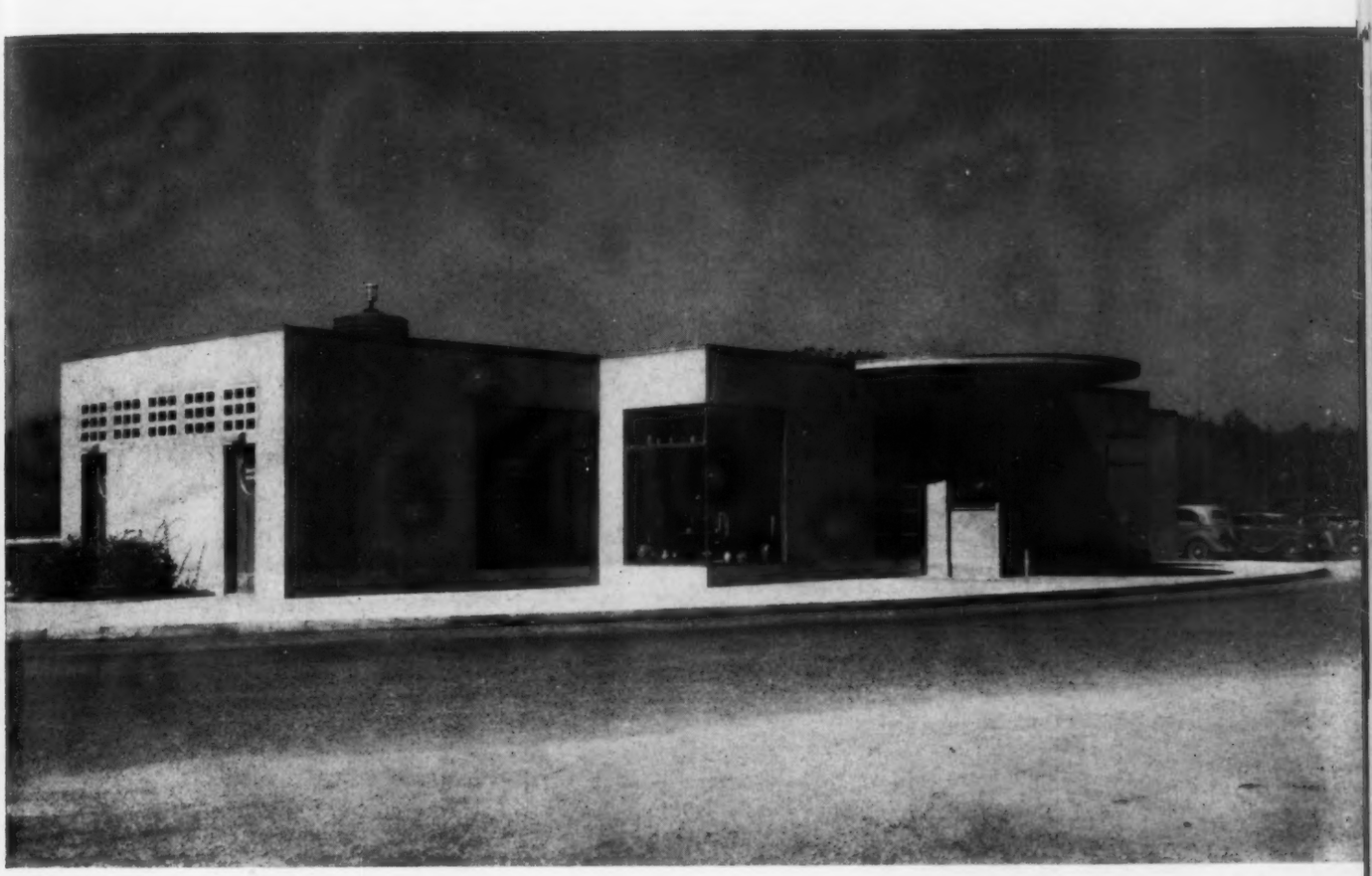


A MORE DISTANT VIEW OF GUNTERSVILLE POWERHOUSE SHOWS ITS RELATION TO THE DAM. BELOW IS SEEN THE UPSTREAM SIDE OF THE GENERATOR HALL ALONG THE TOP OF THE DAM. HERE AS AT CHICKAMAUGA GLASS BLOCK IS USED FOR LIGHTING AND HEAT INSULATION. THE LEVEL OF THE CONTINUOUS LIMESTONE SILL WAS DETERMINED BY THE HEIGHT OF THE CRANE RAIL



THE VISITORS' SERVICE BUILDING AT GUNTERSVILLE IS NOT QUITE FINISHED. IT HOUSES TOILETS AND DISPLAY AND HAS A WIDE OBSERVATION PORCH WITH VIEW OF LAKE, DAM, LOCK, AND POWERHOUSE. STEPS LEAD DOWN RIP-RAP COVERED EARTH DIKE TO A BOAT LANDING. IN-BENDING RAIL STANDARDS HELP TO GIVE SENSE OF SECURITY. NARROW COLUMNS GIVE A CLEAR VIEW

TWO MORE VIEWS OF VISITORS' BUILDING AT GUNTERSVILLE. THE FOUNDATIONS AND BASE ARE OF CONCRETE, THE WALLS AND PORCH COLUMNS OF BUFF BRICK. A BUILT-UP ROOF, FRAMED WITH WOOD JOISTS, HAS A LEAD-COVERED COPPER EDGE STRIP AND FACIA. THE PORCH SOFFIT IS OF INSULATING BOARD PAINTED LEMON YELLOW. NOTE FLUSH LIGHTS



A CORRESPONDING BUILDING AT NORRIS DAM IS LOCATED ON THE EAST ABUTMENT. IT CONTAINS GUARD BOOTH, REFRESHMENT STAND, TELEPHONE BOOTHS, CRAFTS SHOP, LOBBY, TOILETS, AND STORAGE. THE BUILDING IS WOOD FRAME WITH CINDERBLOCK VENEER, STUCCOED WITH LOCAL MARBLE-DUST SAND TO MATCH CONCRETE WORK NEARBY

THE STRIKINGLY BEAUTIFUL VISITORS' RECEPTION ROOM AT NORRIS POWERHOUSE HAS NEVER BEEN ADEQUATELY ILLUSTRATED. ON THIS AND THE FACING PAGE ARE ITS FOUR WALLS. THE FLOOR AND BASE ARE VENETIAN TERRAZZO OF A REDDISH BROWN COLOR FOR THE BORDER AND A LIGHT PINKISH BROWN FOR THE CENTER TO INCREASE REFLECTIVITY. THE PHOTO DISPLAY IS LIGHTED TOP AND BOTTOM BY RANGES OF CONTROL LENS FIXTURES. PAINTED DIAGRAM USED TO EXPLAIN OPERATION OF DAM AND GENERATORS

THE PAN-SHAPED REFLECTING CEILING IS SURFACED WITH ACOUSTIC PLASTER PAINTED JUST OFF WHITE. THE SUSPENDED TROUGH FIXTURE IS OF ALUMINUM AND IS WIRED IN FOUR CIRCUITS FOR DIFFERENT INTENSITIES. THE COVE SOFFIT, ALSO OF ACOUSTIC PLASTER, IS TINTED A REDDISH BROWN AND THE DROP BEAM, IN PLASTER, A STILL DARKER SHADE. THE WALLS ARE BURLAP COVERED AND PAINTED MAROON. ALL METAL SHOWING IS ALUMINUM. FURNITURE IS UPHOLSTERED IN MAROON LEATHER, PIPED

ARCHITECTVRE OF THE TVA

BY TALBOT F. HAMLIN

Building under the jurisdiction of the Tennessee Valley Authority is one of the largest construction projects in the world. Its scope is amazing. It includes dams, power houses, navigation locks, and all the service structures which they require, as well as bridges, recreational buildings, residences, and even gas stations. In plain brute size, measured by any yardstick, whether of money cost, of amount of material used, or of the number of people employed, it is tremendous. And its importance is even greater than its size would indicate; for by its accomplishments not only will the Government of the United States be inevitably judged, but also the whole culture of our present day. The standards which it sets in beauty as well as in efficiency are going to descend as evidences of what we are, for many generations to come.

Educationally, too, it is of vast significance. Built in large measure in portions of the country which before its coming were among the most primitive, its character is bound to affect profoundly the inhabitants of the whole region. To them it stands for the 20th Century United States; to them its buildings appear as the greatest examples of present-day architecture which they have ever seen. In addition, the very size of the enterprise and the fact that it can be reached with comparative ease by automobile from many parts of the Central States have made it a great sightseeing center, and hundreds of thousands—literally—of visitors have poured through its buildings day after day from all over the country. It is, moreover, in a vastly true way, the people's own project. Those who live in its neighborhood feel that strongly. They have made it their own. To them it has become much more than a means of easy navigation, flood control, or cheap power. It has become to them a symbol of their own Government's efforts on their behalf, and they feel for it both pride and a strange kind of affection. This in itself is of course an indication that its design is successful.

This success has been achieved in the face of enormous difficulties. Engineering problems of the most complicated kind had to be solved; large problems in the organization of the work and the handling of the great amount of labor, both skilled and unskilled, which the project required had to be met. And there were the basic human problems. Again and again, in the past, in large engineering projects and many necessary public works, there has been a rivalry between engineers and architects that at times became almost hostility. To many engineers on other works, the architect, if employed at all, has been a thorn in the flesh, an extraneous element hauled in to "prettify" the engineer's otherwise "efficient" solutions. To the architect, in many other works of the type, the engineer has

THE GREAT GENERATOR HALL AT NORRIS POWERHOUSE HAS A BEAUTY THAT WAS NOT ATTAINED ACCIDENTALLY. CAREFUL STUDY WAS GIVEN TO ALL DETAILS AND THEIR RELATIONSHIPS. NOTE THE EFFECTIVE RAILING. HOW SIMPLE IT IS; HOW ADMIRABLE!

seemed an inflexible, unimaginative dealer in mechanical details. Happily—and the results show with what excellent results—this division of interest has never occurred in the ranks of the TVA. The architectural and site-planning group and the engineers from the beginning have worked out a cooperation, a mutual understanding of each other's aims, a true respect for each other's specific skills, which has been exceptionally valuable to both. To the engineers of the TVA, the architect is no longer a mere prettifier; he is, instead, the great humanizer. And, to the architect, the engineer is no longer the hard-and-fast dictator, but, instead, a true partner guaranteeing the perfection of the total result, both mechanically and structurally. Each has learned from the other, and it is only through this magnificent and willing cooperation that these extraordinary results have been achieved.

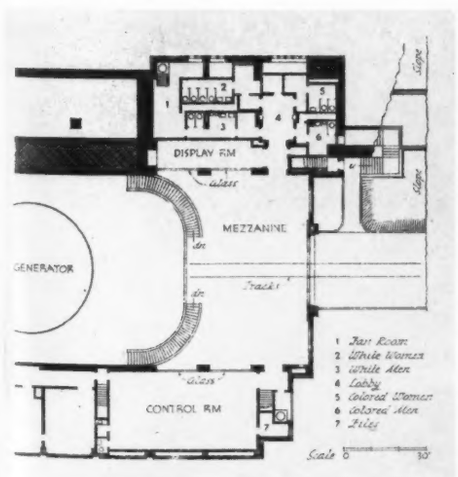
There were almost as many problems with people as there were with water pressures and flows in these buildings. They had to be so designed that the thousands of visitors could be welcomed, directed, and shown easily through the powerhouses and around the dams with no interruption of the efficient working of the entire plant. They had to be given rest rooms, refreshment places, view areas; for, since the whole system was the people's, created by their own Governmental representatives, it was obviously necessary to receive as many of the people as possible, to make them feel as much at home as possible, and to render their visits as truly educational as they could be made. The comfort of large numbers of employees had to be considered, the just placing of control boards, of observation platforms, of locker rooms, toilet rooms, and offices, so that there should be the minimum of lost effort during the day's work, the maximum of pleasant surroundings, the greatest sense of a true—because it is human—efficiency based on individual men and women.

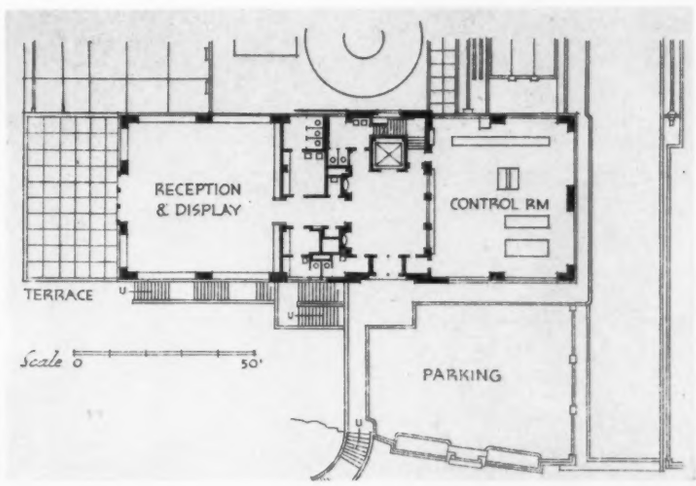
In the course of the study of these various questions, certain general arrangements were developed which hold true in all of the TVA multiple-purpose dams, although of course varied tremendously to suit each local site. The control bay was usually placed at one end of the powerhouse, and so designed that the public flowed into the structure on the ground level, went through the display room and the visitors' office—where, if necessary, guides or lecturers could be detailed to accompany them—then along upper galleries looking down into the powerhouse, and so out again, without ever crossing any line of ordinary working traffic. They are shown everything without interfering with any worker, and this alone entailed the most careful circulation planning. For those who merely wished to see the outside of the buildings and perhaps to cross the dams, other visitors' structures were erected, usually at one end of the dam, where again simple displays sketched the purposes and achievements of the TVA and the relation of the special dam in question to the whole scheme could be explained. Usually, too, these dam structures contained sitting rooms where the view was most superb, and ample, beautifully detailed comfort stations. In some cases, as well, these buildings were combined with small refreshment stands, so that the visitor, after he had stopped to view the water rushing over the spillway or had looked down at the churning water below the dam or the placid lake above, could take advantage of his wait to get a snack and a soda.

In the solutions of this general pattern there has been continual growth and change. No designs have been allowed to become set standards, to be followed irrespective of site. Each problem has been considered on its own merits and solved in accordance with its own requirements, so that it is impossible for a visitor to say that in seeing one of the dams he has seen all. Each is a different problem, and each successive structure has been solved in the light of the lessons learned in the ones built previously.

The powerhouses, for instance, are of three basically different types. In one, where the level of the tail water—that is, the water on the down-stream side of the dam—can never reach the housing of the generators, there is no real powerhouse. The modern enclosures of the turbines and generators,

THE PUBLIC TOILET AND REST ROOMS AT ALL THE TVA POWERHOUSES ARE OF SIMPLE AND CLEAN DESIGN, CARRIED OUT IN MATERIALS WHICH INSURE EASY AND SANITARY MAINTENANCE AS WELL AS DURABILITY. THE VIEW ABOVE SHOWS PART OF ONE OF THE WOMEN'S REST ROOMS AT WHEELER WHICH IS TREATED TYPICALLY WITH STRUCTURAL GLASS WALLS. SOME HAVE TERRAZZO FLOORS, SOME HAVE TILE, ALL ARE COLORFUL. BELOW, VISITORS' ENTRANCE FLOORS OF CONTROL BUILDINGS AT GUNTERSVILLE AND WHEELER REPRESENTING TWO TYPES





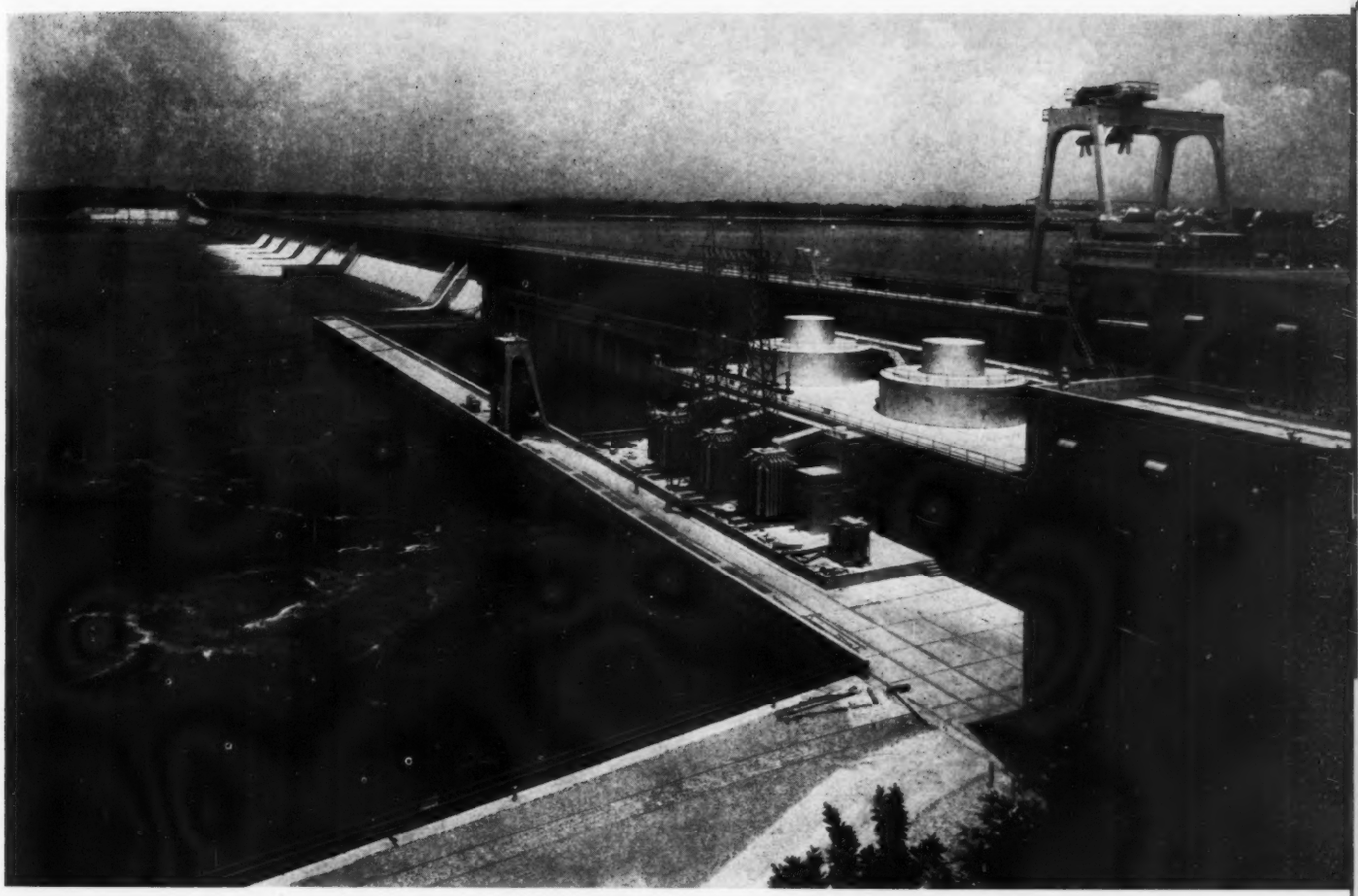
interesting combinations of concentric cylindrical forms, have become so simple and so perfect that they themselves are sufficient shelter for the machinery beneath, and no additional building is necessary. In those dams where tail water can rise to a higher level, of course protection of the generators is necessary, and in that case enclosed powerhouses are used, with the lower walls of concrete designed to withstand pressure, and with upper walls—where water never can come—masonry. Finally, in those powerhouses where water can rise to great heights the entire structure is necessarily of concrete. Thus, in Wheeler Dam the generator tops make interesting cylindrical notes below the level of the dam wall, rising unashamed above their foundations, and between them and the shore at the very end of the dam rises the control building, interesting in its simple rectangular rhythms of glass and wall; an additional note is given by the alternating rhythms of the window divisions themselves.

The simplicity which characterizes the exterior distinguishes the finishes of walls and ceilings and floors within, and the large doors and windows which flood the public spaces with light are a delight, as are the simple lighting troughs that are used here and there for artificial illumination. The visitors' reception room in Wheeler is typical of the warm feeling of welcome that a visitor must invariably get. Lighted naturally from three sides, it is most interesting in color treatment, and one whole wall is devoted to displays dramatizing in beautiful lettering and exciting photograph the related problems of soil erosion and flood control.

In Norris the problems were entirely different. The great height and huge scale of the dam, and the depth of the valley in which it was placed, not only meant that an enclosed powerhouse was necessary, but also, because of the immense scale of the dam itself, entailed an entirely different kind of exterior design. Here, rightly, everything has been done to subordinate the mass of the powerhouse to the sheer battered wall of the dam in front of which it is placed. Its form has been kept a severe rectangular mass; and, in order to give it the proper scale of power, its windows have been treated as successive rhythmically-spaced rectangular openings separated by broad areas of concrete, both vertically and horizontally. It may have been this type of exterior design which suggested one of the first great improvements in earlier usage, a new and creative handling of the exterior of the exposed concrete, by means of a simple adjustment of form work.

In structures of this size it is almost impossible to guarantee uniformity of color throughout in exposed concrete work. In any concrete, stain is bound to happen, and the use of plain, dressed-board, horizontal forms at Pickwick did little to conceal color variations or inequalities of staining. There was sufficient roughness in the form boards employed so that the exterior is not a dead gray. The walls have life. Yet the inevitable staining and the slight variations in color have not helped the appearance of the plain surfaces on which the design of the building depends. In Norris, the rhythmical handling of the windows is combined with a similar treatment in the form work. The forms were built in panels of generally uniform size, with the boards running alternately vertical and horizontal in adjoining panels. The result is a kind of checkerboard, elongated, for the panels are rectangular and not square; and at once much of the difficulty consequent on the nature of the concrete itself disappears. The subtle change of light between the panels with horizontal and those with vertical joints gives most interesting surface patterns, which somehow completely obscure color inequalities, and the deep joints between the panels give sufficient interest without destroying unity. It is a type of concrete building which retains all the power of exposed concrete work, expresses its cast nature, and still at the same time obviates its difficulties.

The interior of the powerhouse has its disadvantages. Its deeply trussed roof, though basically simple in pattern, is a poor reflector of light; and the arrangement of the windows is such as to darken the ceiling still



LOOKING FROM THE CLIFF-TOP PAST THE WHEELER CONTROL BUILDING, TOWARD THE DAM, ONE SEES THE HUGE CYLINDRICAL FORMS OF THE GENERATOR CASINGS WHICH ARE WEATHER TIGHT. MAXIMUM TAILWATER LEVEL LOW SO NO GENERATOR HALL IS NEEDED. BELOW, LOOKING BACK FROM BESIDE GENERATOR TOWARD CONTROL HOUSE AT NIGHT

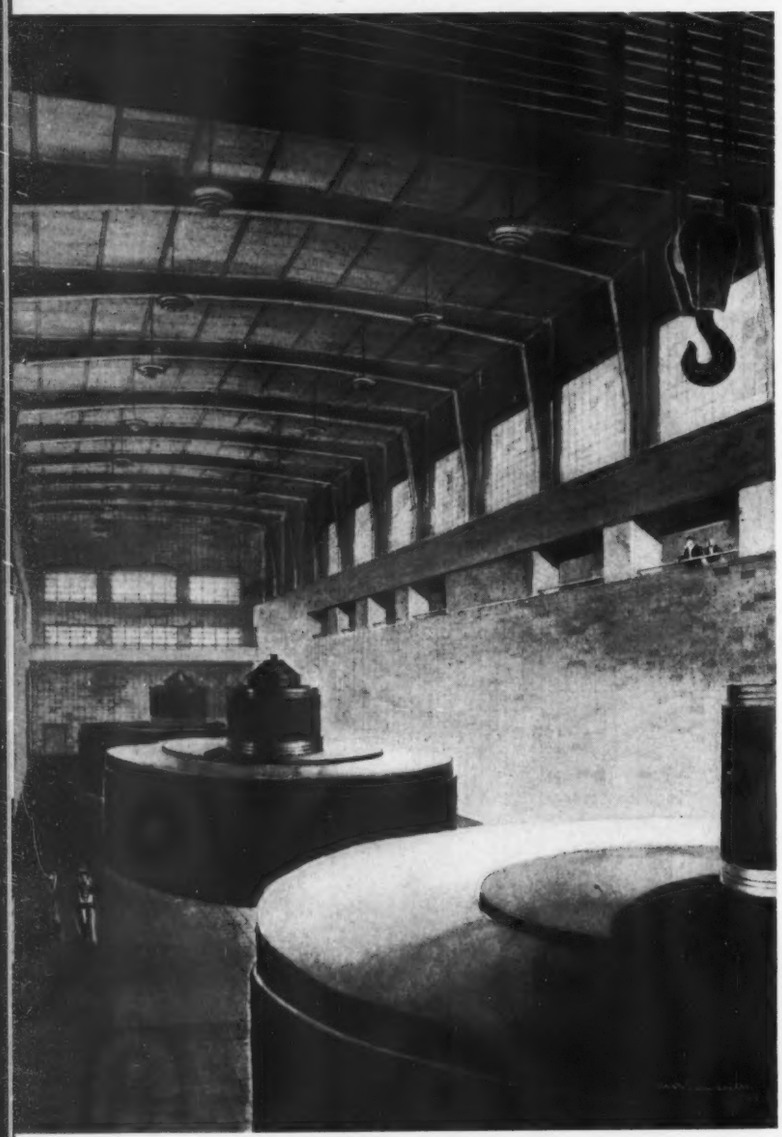
NORRIS DAM IS MORE SPECTACULAR THAN THE DOWN RIVER DAMS BY REASON OF ITS GREATER HEIGHT. THE POWERHOUSE AT ITS BASE, ITSELF A SIZABLE STRUCTURE, IS DWARFED BY ITS MAJESTIC NEIGHBOR. AT THE BOTTOM OF THESE TWO PAGES ARE THREE TYPICAL HOUSES IN THE TOWN OF NORRIS. THEY SHOW THE HONEST APPROACH TO DESIGN SEEN IN THE DAM

more. The powerhouse is a beautiful hall in its fundamental proportions, but in illumination, as in certain elements of finish, it still leaves something to be desired.

Norris of course is famous for much other building of unusual quality. The whole village, set so attractively among the trees, has been criticized as too romantic in its labyrinth of curving roads, and too historical in its usual type of house design. But the whole purpose of the plan was to make the most of an exceedingly uneven site—to follow contours, to preserve beautiful groves of trees, to blend the village as far as possible with the neighborhood. And the design of the houses followed in the main from the nature of the materials used. As far as possible these were local—a pleasant rough stone, and timber;—and in those houses which were built without change from the architect's original plans there is a beautiful natural simplicity in the gabled roofs, the quiet walls, the large windows, and the protected porches. One of the most interesting things in Norris is the post office. Its interior is done chiefly in plywood at a remarkably low cost, and by setting window and door heads at the same level, carrying a board around just above this, lining all the wall faces below with natural plywood, and the upper walls and ceilings with the same ¼" three-ply fit, painted a light color, a most delightful, unified, "designed" character has been achieved. There is no fuss or feathers about it, but there is thought and proportion, and there is lovely color treatment in the ceiling, enlivened by large circles over the lighting fixtures. One would commend it unreservedly to the Office of the Supervising Architect at Washington for a careful study of what a cheap post office may be. It is so refreshing a contrast to the usual stuffy interiors that have become apparently and unfortunately standardized in the Federal Architect's work.

In Pickwick Landing a powerhouse of different type was produced. Here the old horizontal form work was used, for Pickwick was begun while the results at Norris were still considered experimental. In Pickwick the long, simple, rectangular power-

THE INTERIOR OF THE LITTLE NORRIS POST-OFFICE IS EFFECTIVE BY REASON OF ITS SIMPLICITY. THOUGH LOW IN COST, IT HAS PLENTY OF DIGNITY AND REFINEMENT



THE HUNG CEILING IN GUNTERSVILLE'S GENERATOR HALL WAS PARTLY TO HIDE ELABORATE TRUSSWORK. AT CHICKAMAUGA, STEEL RIBS PROVIDED A BETTER ANSWER

house carries the steel grid of the high voltage wiring on its roof, so that there is a most interesting contrast between the blocky forms of the concrete and the lacy forms of the steel. Yet even here the designer's hand has been at work, so that the proportions of the steel frame fit beautifully into the entire composition. At the shore end of the powerhouse rises the control building, like a simple pylon, almost Egyptian in its quiet strength. The interior of the powerhouse is a definite step ahead. The light is more perfectly distributed, and the whole system of walls has become cleaner, simpler, more direct.

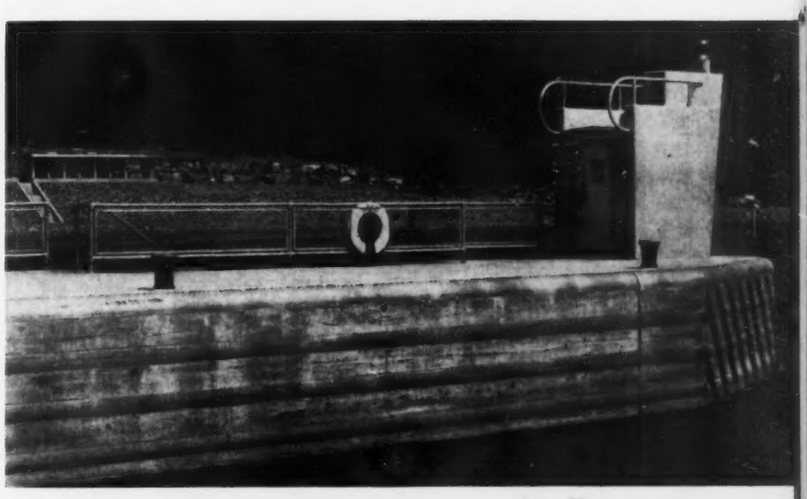
Another step ahead was made at Guntersville. Here the powerhouse was frankly in two sections: a lower section of concrete to resist possible flood waters; an upper section of buff brick. The concrete walls are treated as in Norris, with a checkerboard of form patterns alternately of vertical and horizontal boards. The whole design has been simplified and everything done to emphasize the horizontal quality. For the first time, too, in the effort to obtain the greatest possible diffusion of light, a frieze of glass block was used in the upper part of the walls to light the interior, and a hung ceiling was installed as part of the ventilating system, and this also hides the confusion of the light-devouring truss work. Aesthetically, the exterior is one of the most successful of all of the TVA powerhouses, interesting in rhythm and with a magnificent serenity in its long horizontal lines, which combine with the horizontal of the dam top and contrast dramatically with the cross-walls of the dam gates. The powerhouse interior, too, is lighter, pleasanter, more airy than any of its predecessors; but the use of the hung ceiling was, in a way, a compromise and not a perfect solution of the problem. This was only reached in Chickamauga, where, both outside and in, the final steps of complete integration between the engineering elements, the spillway walls, and the powerhouse structure itself—the exterior and the interior—have been completely effected. The powerhouse is one of those subject to possible flood; hence its concrete walls rise

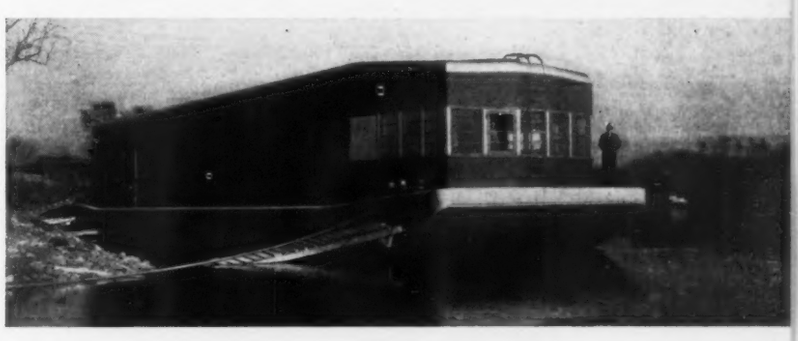
in stately and simple power to the frieze of glass brick and windows which lights the upper-story offices. The end bay is of the pylon type found in Pickwick Landing, but designed with more power, more vivid and gorgeous scale.

The whole structure as it rises above the roof stone rip-rap embankment is, to my mind, one of the great conceptions of American architecture. In this building, too, additional refinements in the concrete treatment have entered in, for the alternation of vertical- and horizontal-patterned panels is interrupted by smaller horizontal bands, given an almost smooth and mirror-like texture by using plywood forms for these areas. Extremely interesting is the slight recessing of the piers between the windows, as is the emphasis on the horizontal obtained in the ventilating sash.

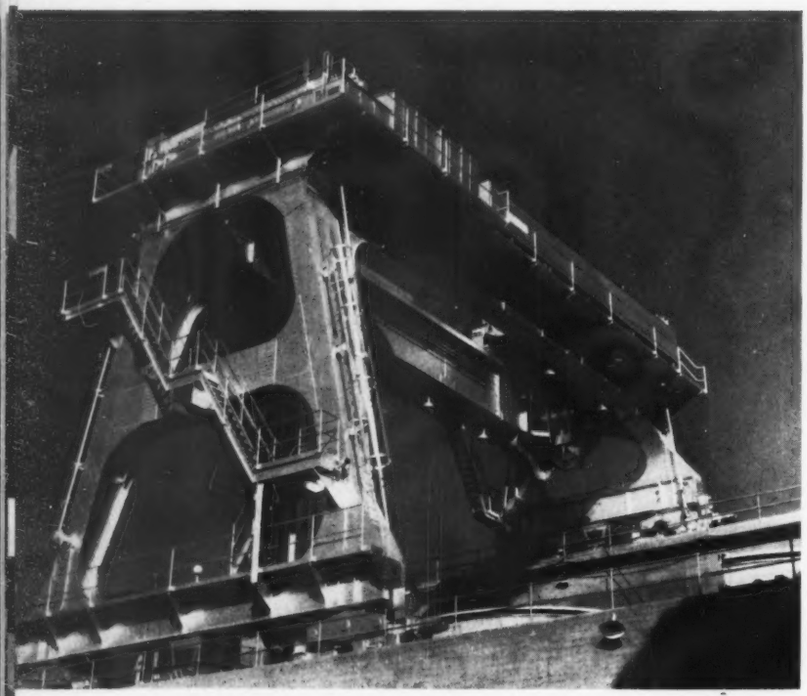
And the same quality carries through into the interior. The three great generator tops march down the center with unbroken simplicity and majesty. The walls rise clear to the visitors' gallery on one side and the frieze of light on the other; and above these the framework is built of welded-steel, braced-arch construction. Gone is the earlier confusion of dark and complicated truss work, gone too the compromise of the hung ceiling. Instead, one gets the clean lines of the graceful steel arches, tied together by the delicate purlins connecting them, and between them merely the under-surface of the precast pans. This is stripped architecture to suit the most puritanical functionalist, but it is stripped architecture endowed with grace and the beauty of excellent proportion. It is characteristic of the TVA cooperation that such a result could only be obtained by the most immaculate engineering working sympathetically with the most imaginative design.

The results of the same cooperation are shown in the navigation work—the locks and their control buildings, which are an essential part of the entire scheme. This system has opened wide areas to effective and profitable navigation; and already the barges and tugboats are carrying the products of the uplands down towards the Ohio, and





IMAGINATIVE DESIGN IS EVIDENT IN THE QUAY AND GAUGE HOUSE AT TOP, THE LOCK CONTROL HOUSE BELOW IT, AND THE REFRIGERATED PRODUCE BARGE AT BOTTOM



THE STRIKING GANTRY WHICH MOVES GENERATOR PARTS WHEN NECESSARY AT WHEELER WAS CONSIDERED ADVANCED IN DESIGN WHEN IT WAS INSTALLED. ITS LATER COUNTERPART IS SHOWN OPPOSITE

allowing bulk freight of manufactured goods to be brought cheaply and simply into the hinterland. The locks, occurring at all the run-of-river dams have long projecting quays. At the end is usually a gauge house, where the exact level of the river can be read. These little gauge shelters, placed at the entrance of the locks, carry also the navigation lights. The ends of the railings of the top platform are treated in interesting curves; the ladders of approach, bent steel rungs inserted in the concrete, are direct; and the projecting sloped fin on which the lights are carried adds a vivid note. The interesting handling of the lining of the lock, with its simple quarter-circle profile above and the alternation of flat and slightly projecting elements, has remarkable variety and life. The control rooms, from which the lock gates are operated, are simple structures of concrete, with broad window areas directed towards the lock; yet, simple as they are, the difference between their design and that of the ordinary lock gatehouse in the usual American canals shows the originality and the imagination of the TVA designers. In the usual lock there is a little rectangular building for operating machinery, and no attempt is made to afford the operators a view of the lock itself from the inside. The TVA operation buildings are so designed that their windows command both sets of gates, so that there is instant visual control of boats passing through and approaching in either direction. This is a little thing, to be sure, but it is a characteristic evidence of that kind of careful forethought and unconventional imagination which has resulted from the close cooperation of engineers and architects.

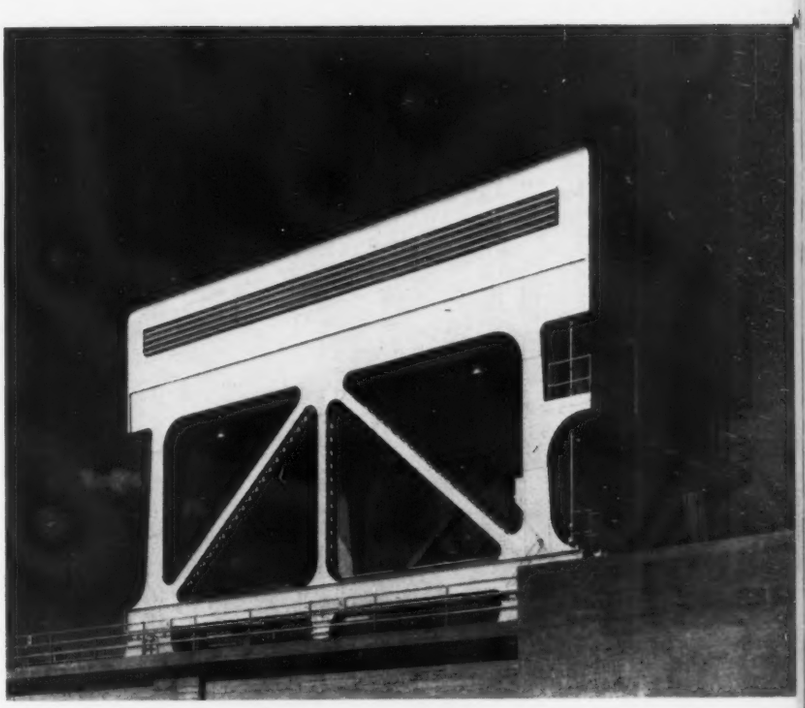
In the TVA work itself there is a significant evidence of advance even in purely mechanical features. The traveling crane at Wheeler dam was a superb piece of engineering, dramatic in its forms, and full of that kind of complexity of pipes, conduits, pulleys, boxes, wheels, ladders, and riveted frames which is the conventional layman's idea of a great machine. For its time it was an advanced piece of design; nevertheless the TVA designers could not rest satisfied —it seemed full of unnecessary complexities. The newer cranes and lifts, such as one finds in Pickwick Landing or Chickamauga, are totally different in feeling. In them everything has been simplified, coordinated, made more compact, and then housed in straightforward, well-ventilated protective coverings; so that the newer machines not only look smaller, more graceful, and more efficient, but they are also, according to the engineers, better designed as machines, and at the same time, as the architect desired, they fall much more truly into the picture of the new dams and become much more definitely part of the entire composition. All the old false romanticism of the machine has disappeared.

The more purely "architectural" elements in the project are an equal pleasure to look at, to visit, to study. The simple panel treatment of the visitors' buildings at Pickwick Landing dam is an excellent example. These twin structures are designed with pleasant large glass areas, and wall units of equal widths, and the effect is direct and attractive. Interesting also is the dam parapet

at Norris, with its large rounded upper rail, so pleasing to lean on, and its lights recessed in the railing supports so as to shine on the roadway without dazzle. The gauge buildings, with their interesting ladders and railings and navigation light mountings, have already been mentioned, and a special word is due about the beautiful displays in the visitors' buildings. Formed in successive panels of diagram and photograph, with the simplest, most legible, but most beautifully proportioned lettering, they tell their story with all the more power because of their quietness.

In the success of TVA construction there seems to me to lie an enormous hope for the future of American architecture and American engineering. These are not the only buildings in which this close cooperation of architect and engineer has been achieved; especially in many of our bridges something of the same feeling of creative form, developed through a similar understanding between the two professions, is more and more evident. One might cite such things as the Bronx-Whitestone bridge, with its exquisite simplicity of tower, its graceful delicacy of structural form, its beautifully designed anchorages which so directly express the stresses within them. Here, too, the beauty came from close cooperation. It is this same kind of cooperation, which the TVA more than anything else has expressed, which has made its buildings—its dams, its powerhouses, its navigation locks—things of architectural beauty.

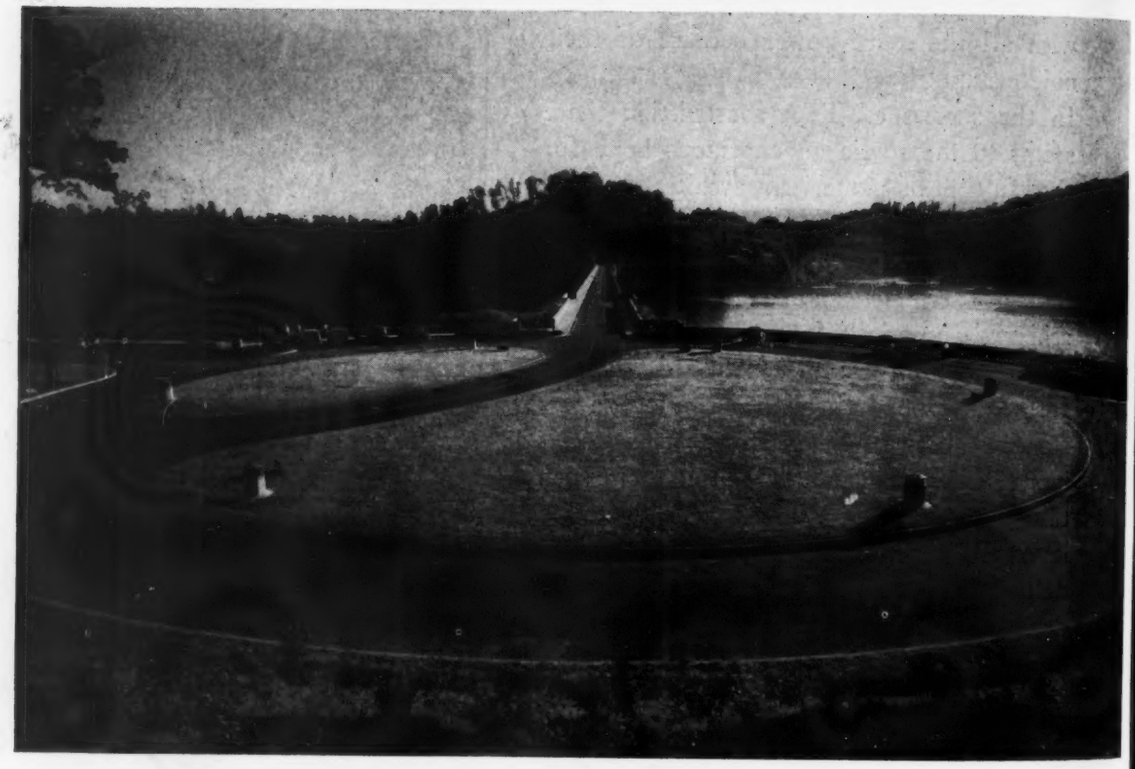
There is also, I think, in the TVA project another, even deeper, source of hope and confidence. It is the world's most striking contemporary example that planning—large-scale planning—is possible in a democracy; that no such false efficiency as that of a dictatorship is necessary to produce great national works, conceived and executed for the benefit of all the people. Perhaps one could go further and even say that, under a dictatorship, that controlling atmosphere which creates the humanity and charm of much of the TVA work would have been impossible. The designers have somehow, through subtle design and human planning,

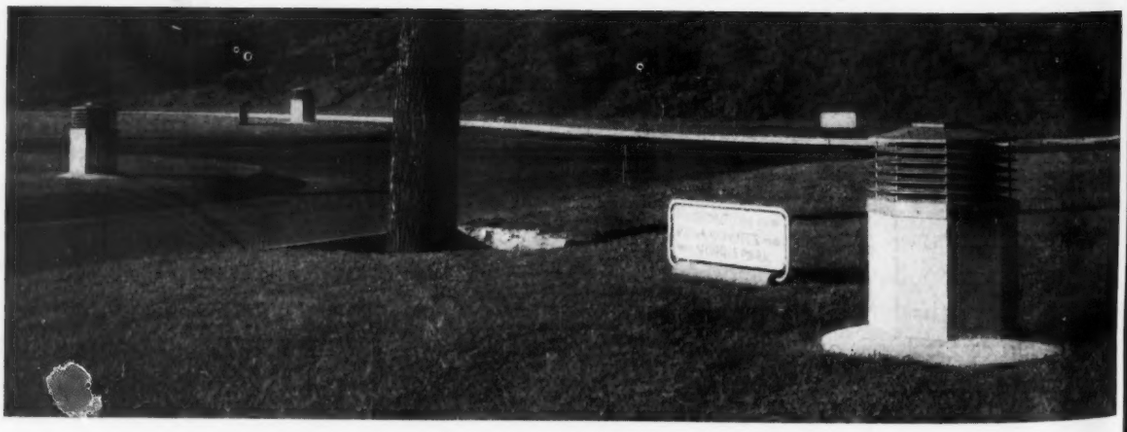


THE TYPE OF GANTRY USED AT GUNTERSVILLE, CHICKAMAUGA, AND PICKWICK IS GREATLY SIMPLIFIED EXTERNALLY AND BY BETTER COORDINATION OF ITS WORKING PARTS HAS BECOME TRULY MODERN

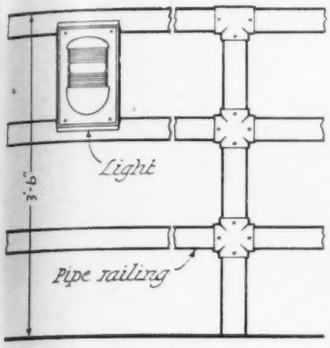
set human beings as the center of the whole scheme. Before these buildings one feels inevitably that, despite their size, despite the billions of gallons of water which they control and the several millions of horse-power they generate, they all exist for the advantage of simple human persons, for the common good.

Perhaps this matter of democracy goes even deeper than the mere purpose of this enterprise; perhaps it is this ideal of democracy itself, permeating the entire TVA organization, which has made possible within it a type of enthusiastic, sympathetic, understanding cooperation that no other system could produce. If the world is to progress in these highly mechanized times, tremendous public works, tremendous efforts at planning will be necessary. It has long been the boast of totalitarian thinkers that only in their system is efficient large-scale planning possible. In the achievements of TVA the United States has proved the contrary, and for that the TVA projects gain an importance which may even transcend their entire practical performance.



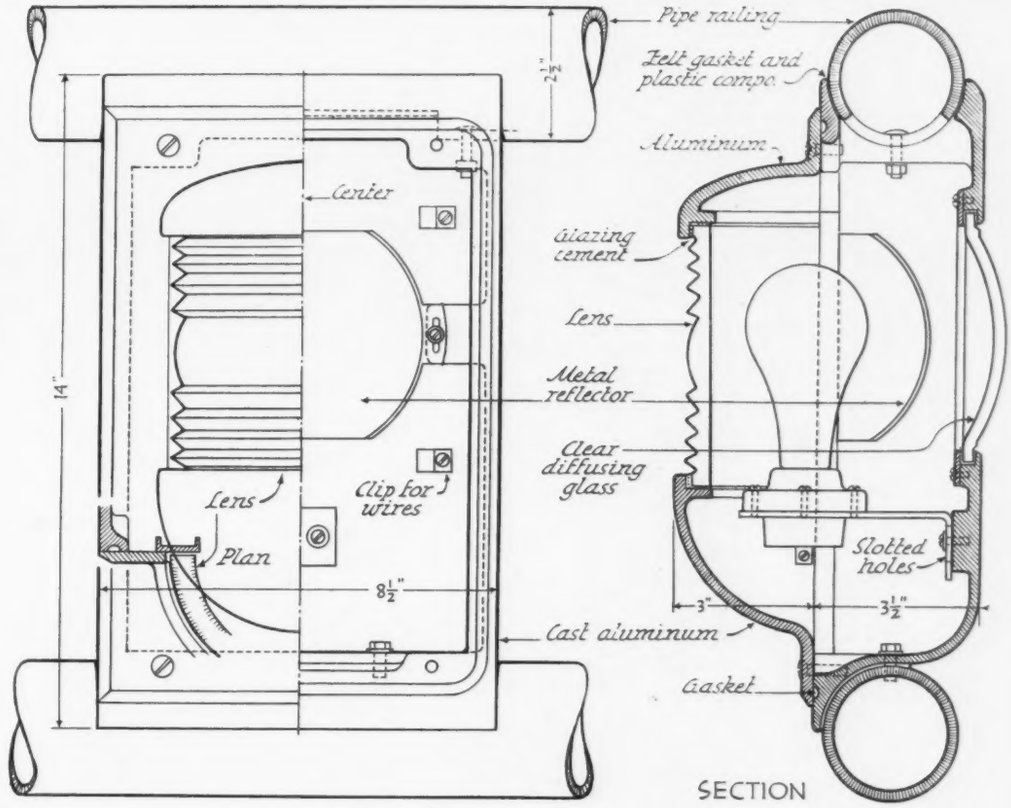


THE TRAFFIC CIRCLE AT THE EAST ABUTMENT OF NORRIS DAM IS NOW LIGHTED BY A SET OF INGENIOUSLY DESIGNED LOW FIXTURES WHICH ILLUMINATE ROADWAY WITHOUT GLARE. DETAILS OPPOSITE. ALSO DETAILED OPPOSITE ARE THE SPECIAL FIXTURE FOR PICKWICK LANDING HANDRAIL (PHOTO ON PAGE 738) AND THE METHOD USED FOR ATTACHING LETTERS TO MASONRY WALL AT GUNTERSVILLE. (SIMILAR LETTERS AT GUNTERSVILLE SHOWN ON PAGE 729)

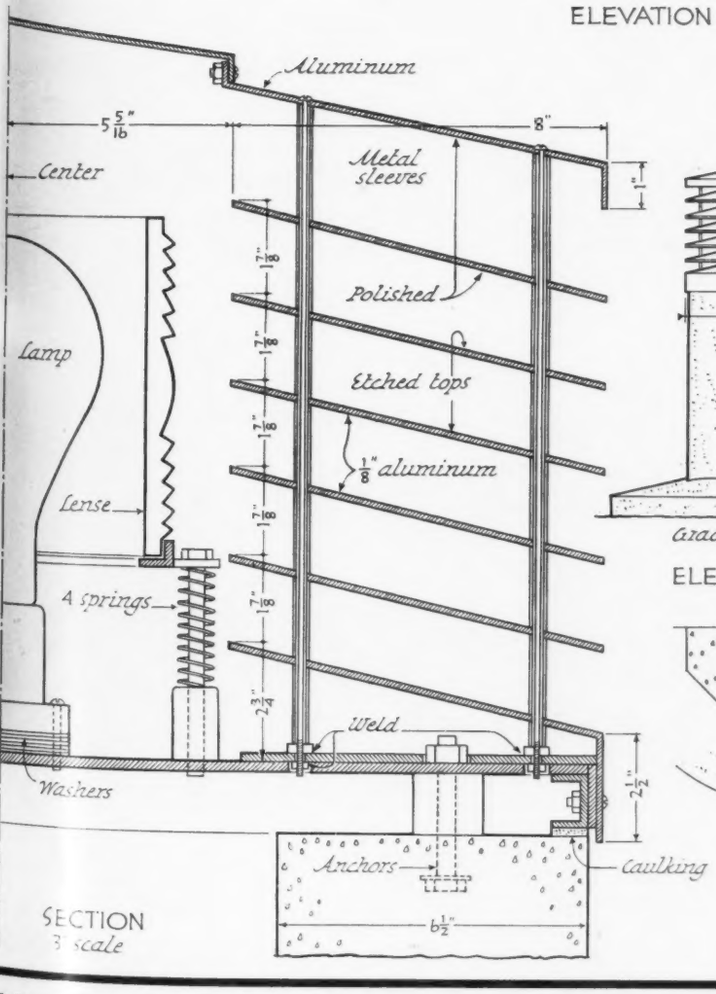


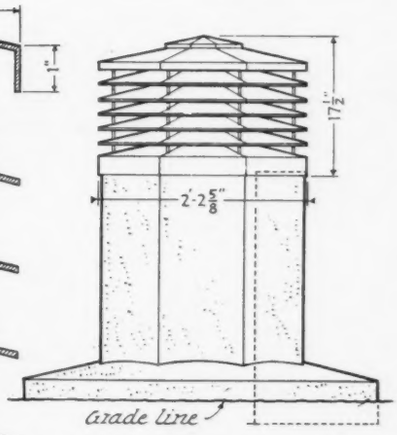
RAIL ELEVATION $\frac{1}{2}$" scale

THE ARCHITECTURAL WORK PRESENTED HERE HAS BEEN DESIGNED UNDER THE LEADERSHIP OF ROLAND A. WANK, PRINCIPAL ARCHITECT; HARRY B. TOUR, SENIOR ARCHITECT; AND THEIR ASSISTANTS, MARIO BIANCULLI AND HIRAM OSTRANDER. THESE MEN WORK UNDER THE DIRECTION OF THEODORE B. PARKER, CHIEF ENGINEER, AND EARLE S. DRAPER, DIRECTOR OF REGIONAL PLANNING STUDIES, OF THE TENNESSEE VALLEY AUTHORITY



ELEVATION 3" scale





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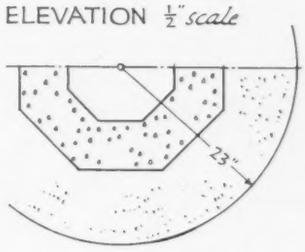
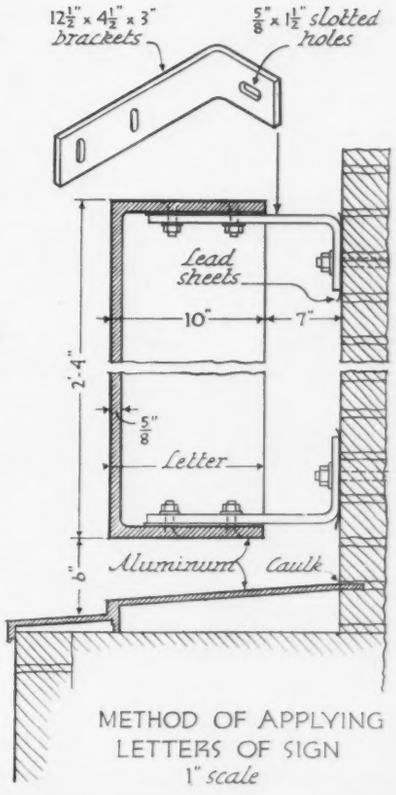
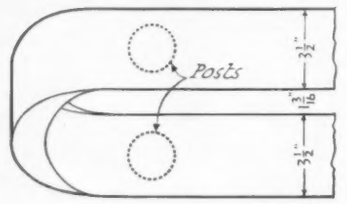
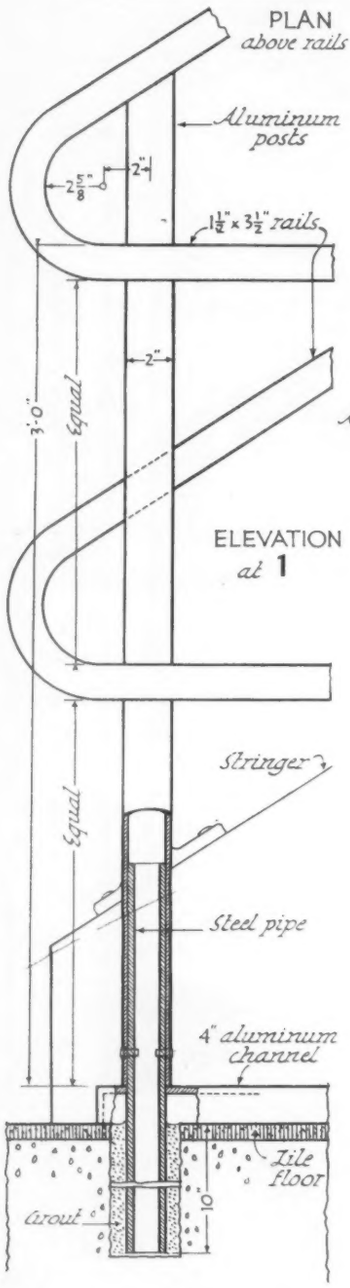


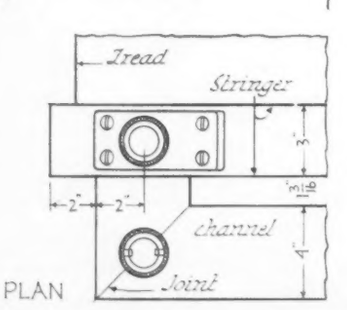
PLAN

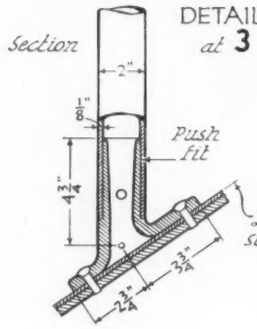


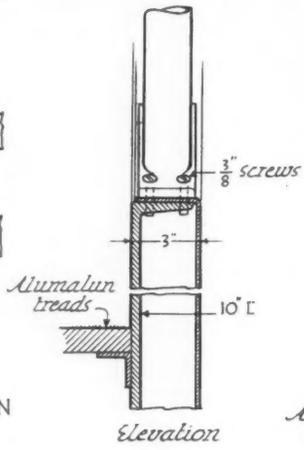
METHOD OF APPLYING LETTERS OF SIGN
1" scale

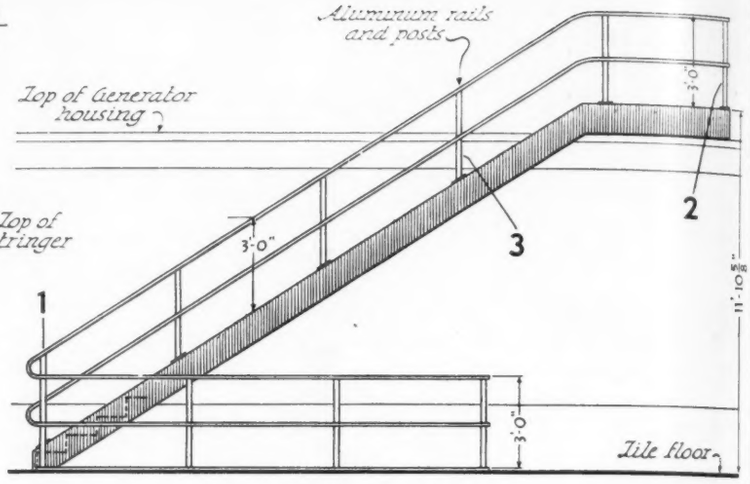


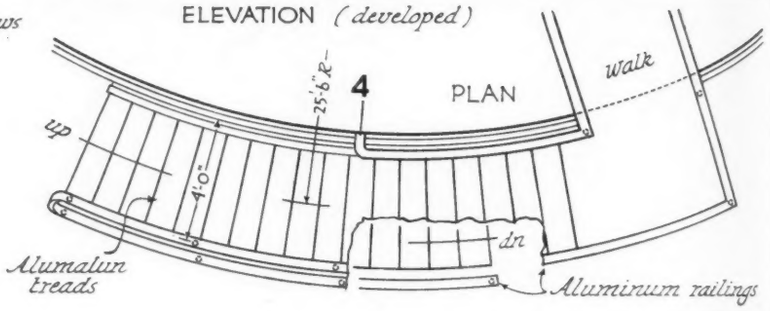


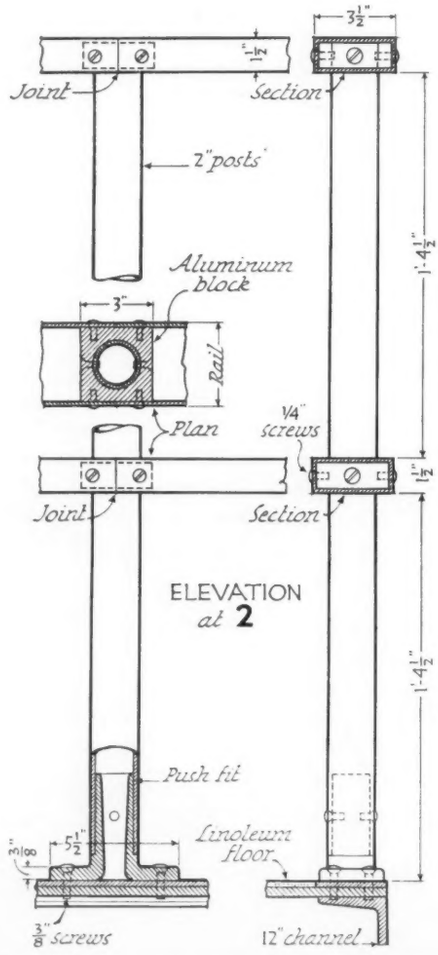


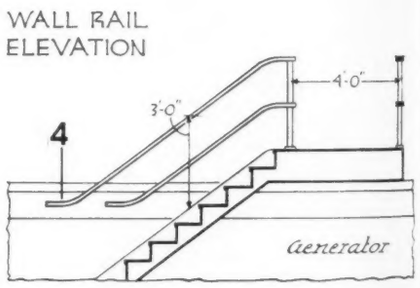






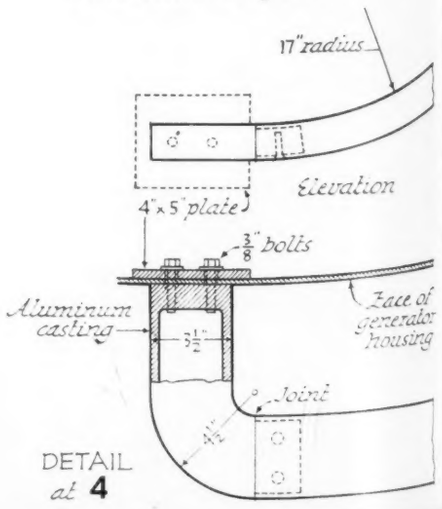


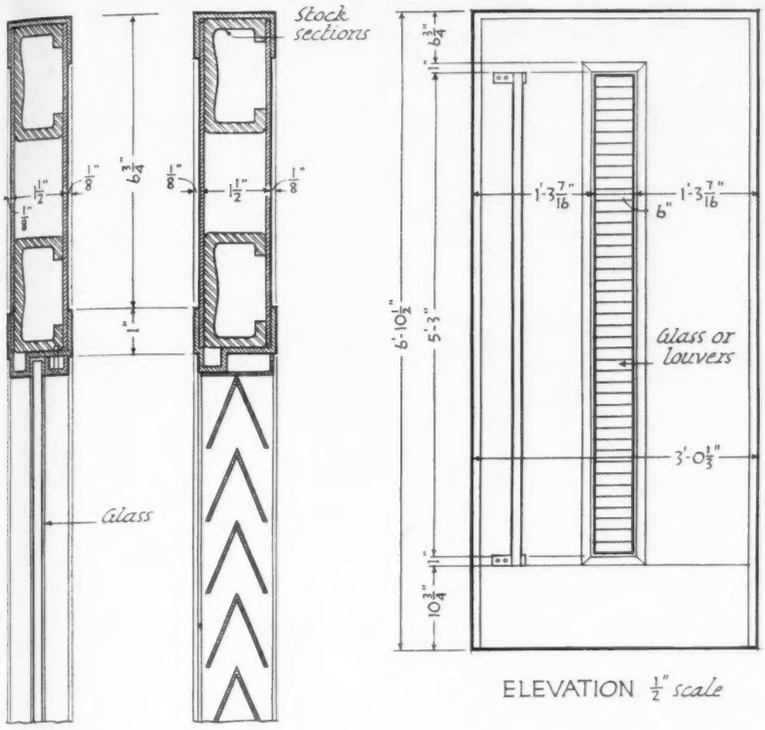




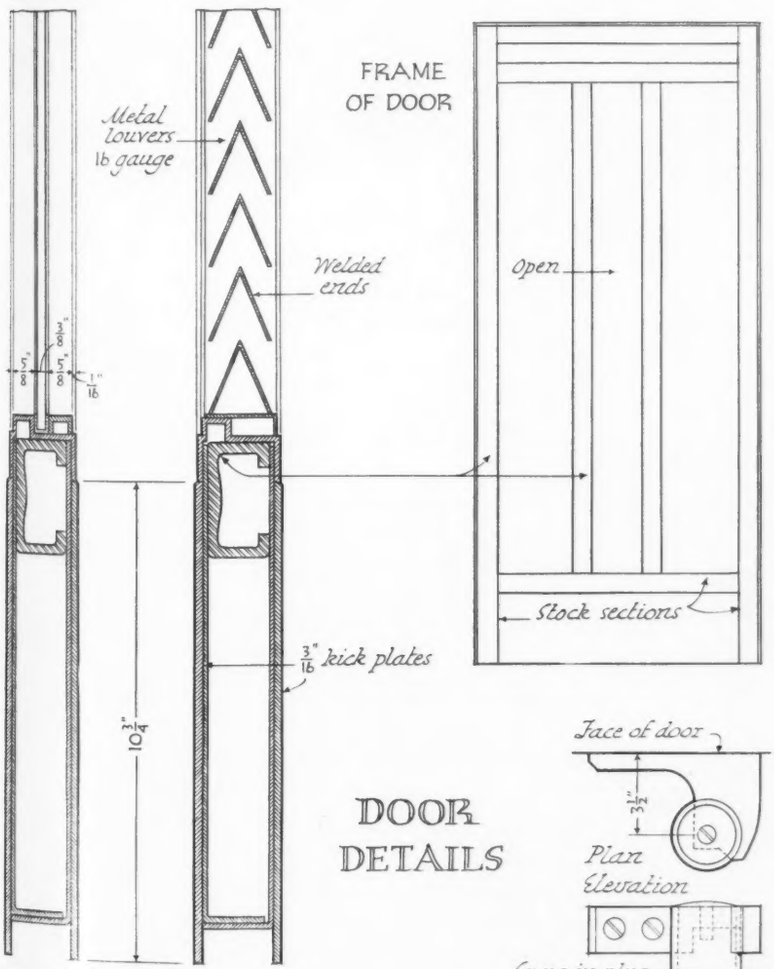
STAIR DETAILS

All sections at 1½" scale





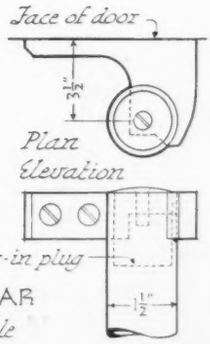
ELEVATION $\frac{1}{2}$" scale



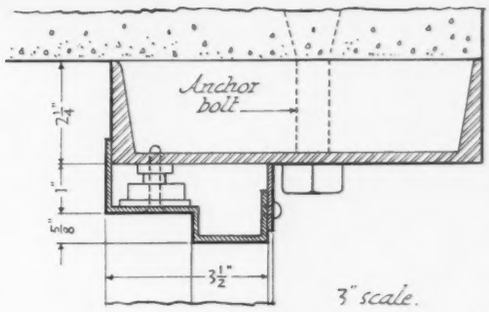
FRAME OF DOOR

SECTION Thru DOORS
3" scale

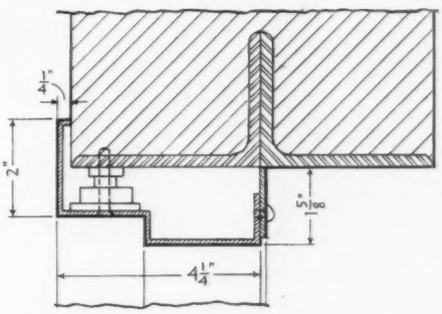
DOOR DETAILS

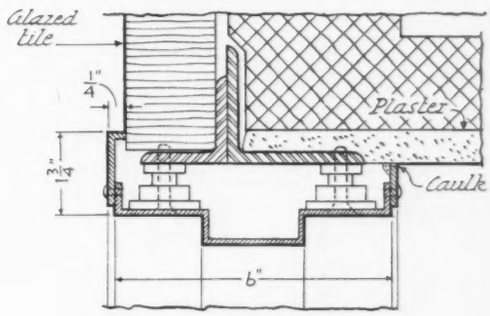


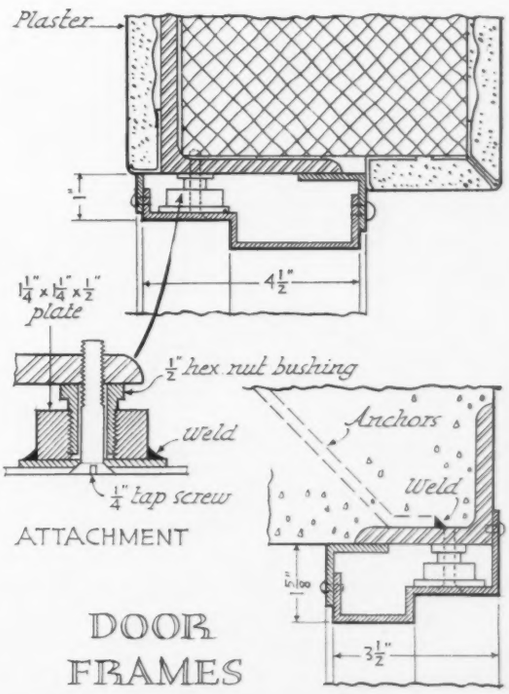
PULL BAR
3" scale



3" scale.

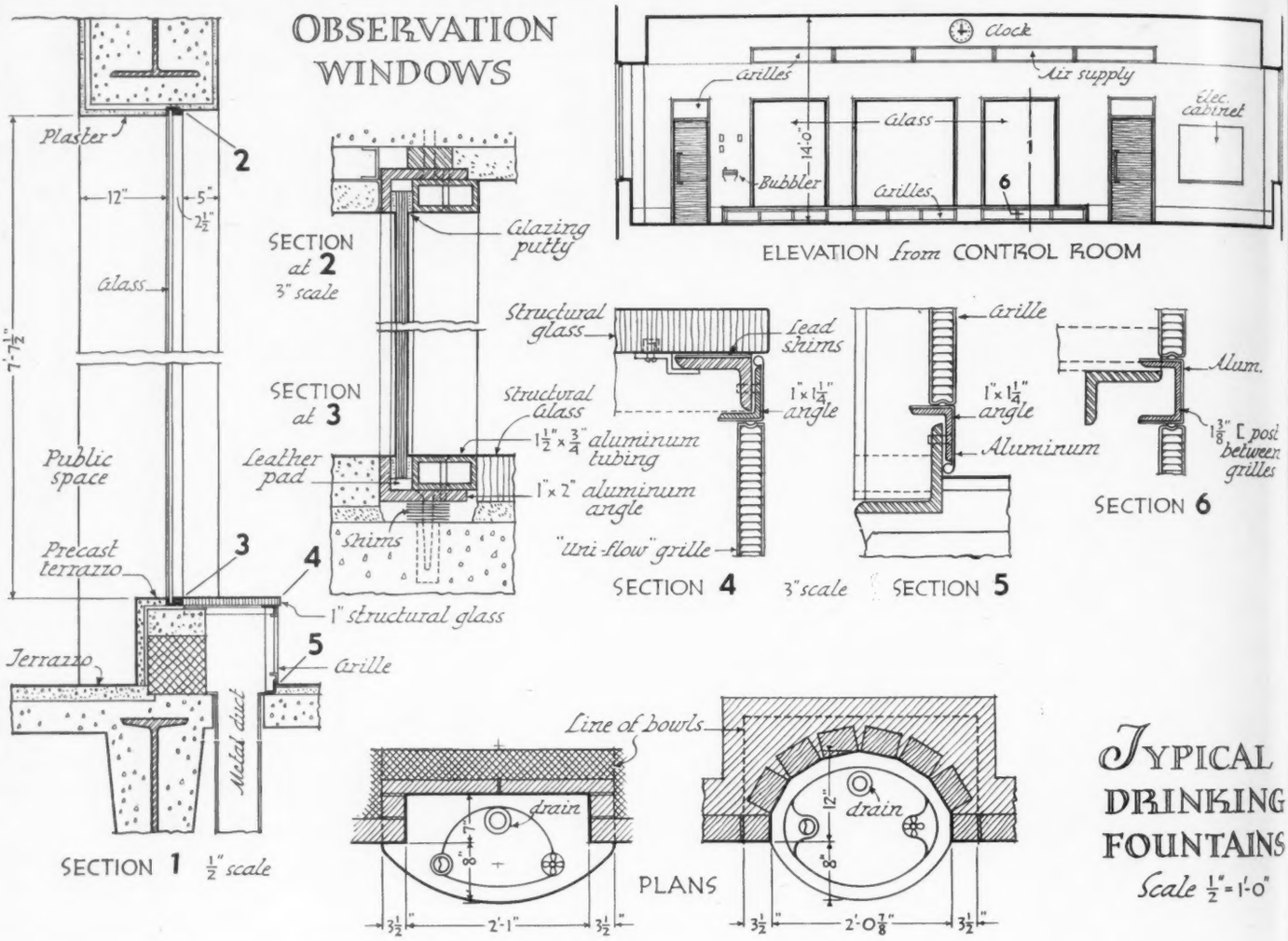


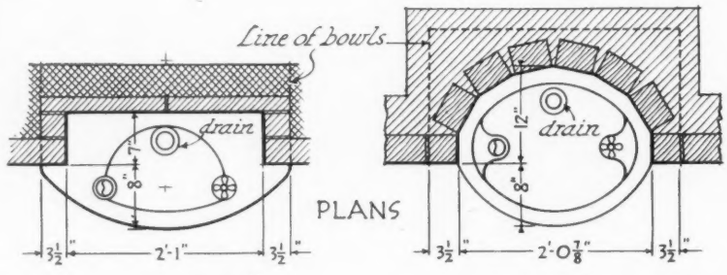




ATTACHMENT

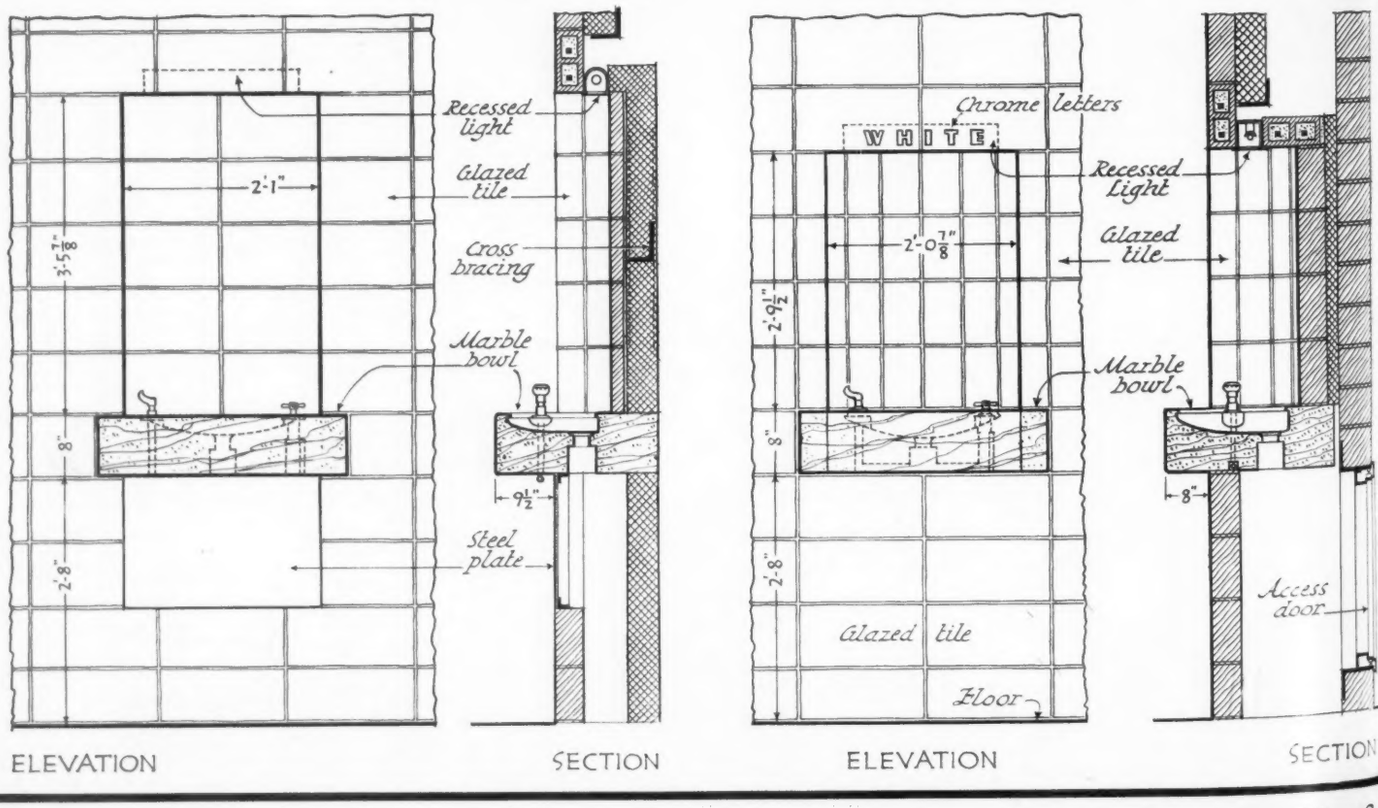
DOOR FRAMES

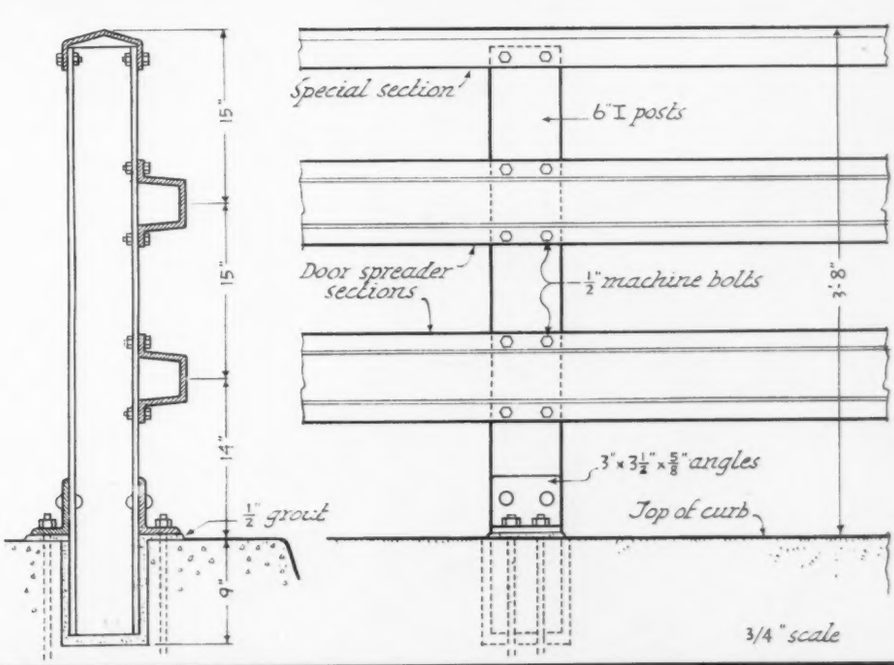


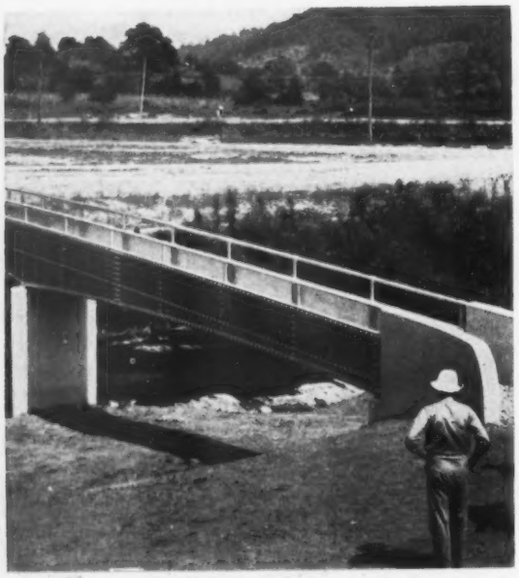


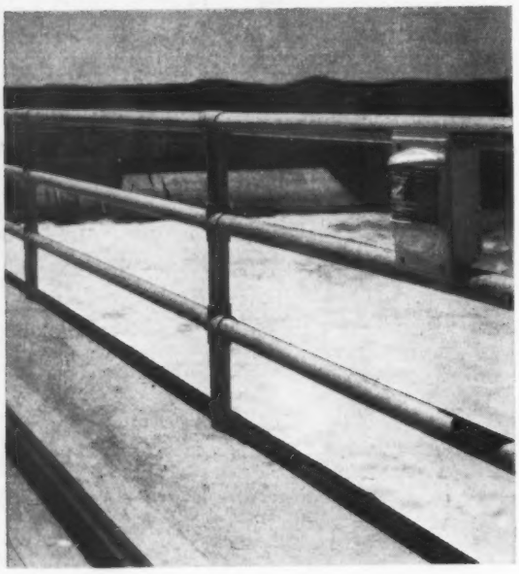
TYPICAL DRINKING FOUNTAINS

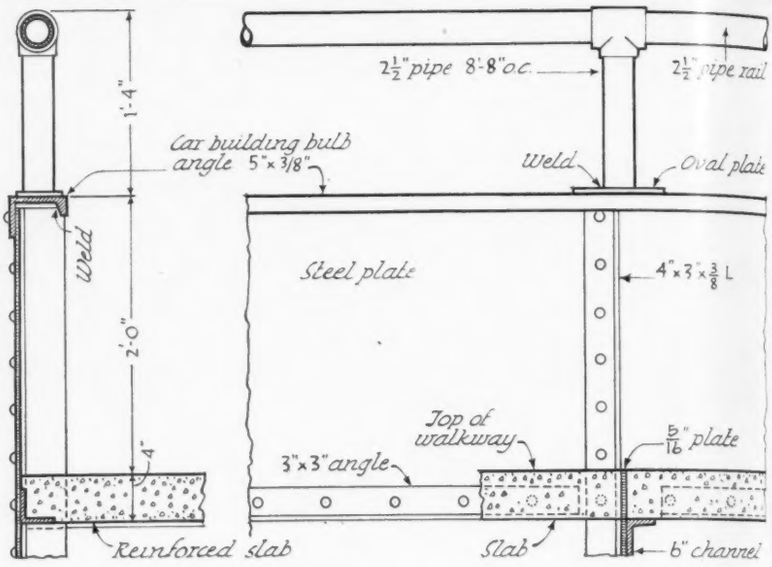
Scale ½" = 1'-0"

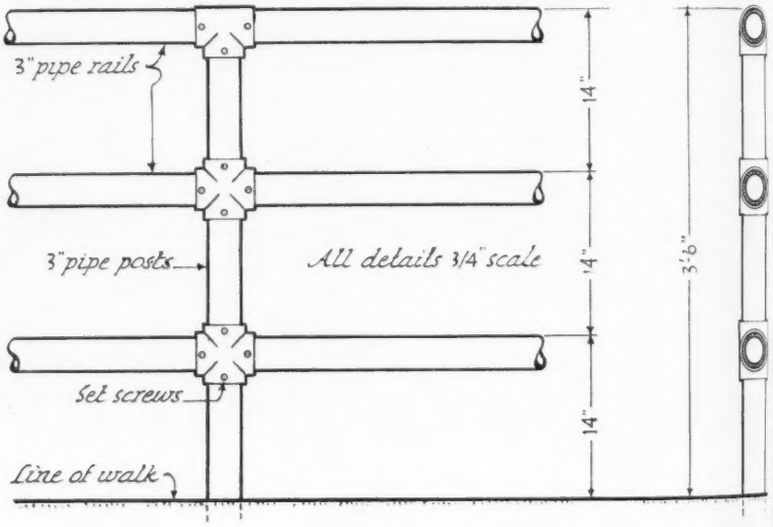


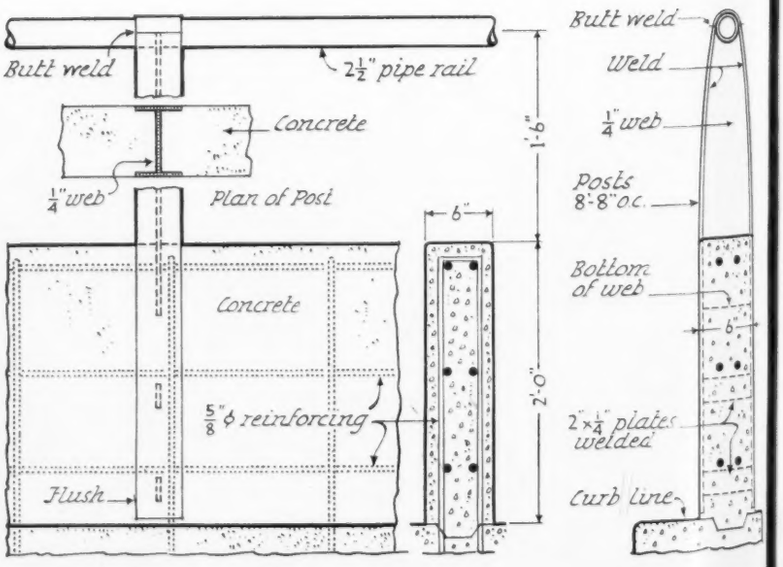

15"
15"
14"
9"
½" grout
Special section
6" I posts
Door spreader sections
½" machine bolts
3'-8"
3" x 3½" x ⅝" angles
Top of curb
3/4" scale

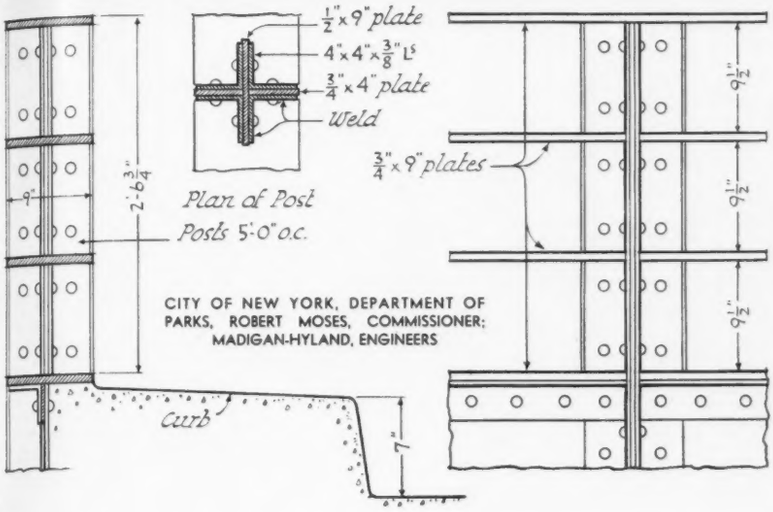




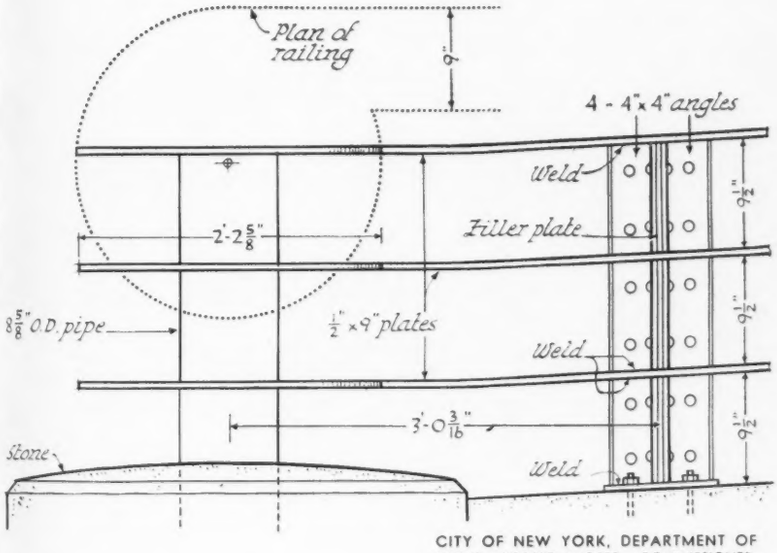

2½" pipe 8'-8" o.c.
2½" pipe rail
1'-4"
Car building bulb angle 5"×3/8"
Weld
Oval plate
Weld
Steel plate
4"×3"×3/8 L
2'-0"
Top of walkway
5/16" plate
3"×3" angle
4"
Reinforced slab
Slab
6" channel


3" pipe rails
14"
3" pipe posts
All details 3/4" scale
14"
3'-6"
Set screws
14"
Line of walk


Butt weld
2½" pipe rail
Butt weld
Weld
Concrete
1/4" web
1'-6"
1/4" web
Plan of Post
Posts 8'-8" o.c.
6"
Concrete
Bottom of web
5/8" ϕ reinforcing
2'-0"
2"×1/4" plates welded
Flush
Curb line

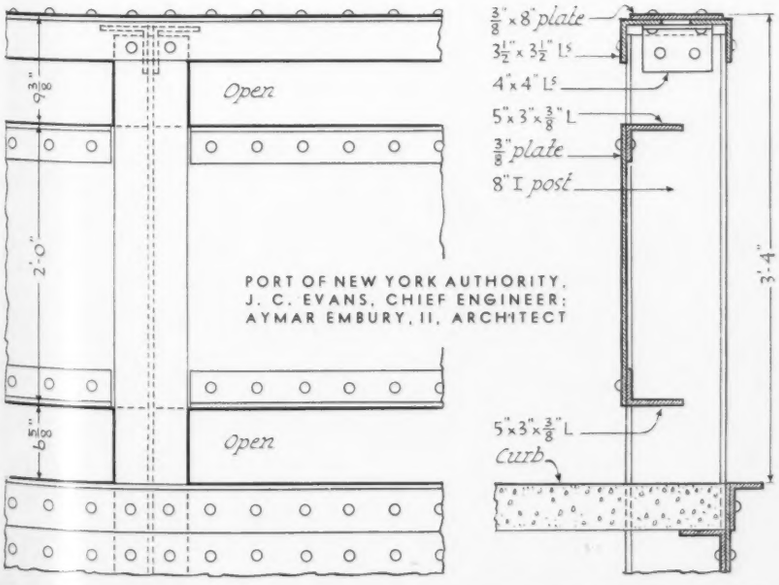


CITY OF NEW YORK, DEPARTMENT OF PARKS, ROBERT MOSES, COMMISSIONER; MADIGAN-HYLAND, ENGINEERS

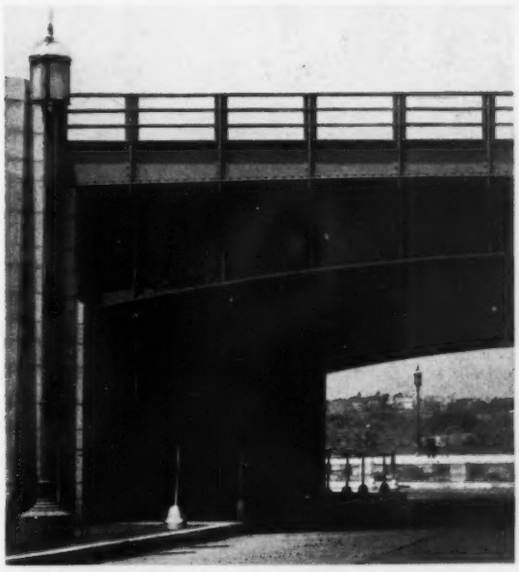


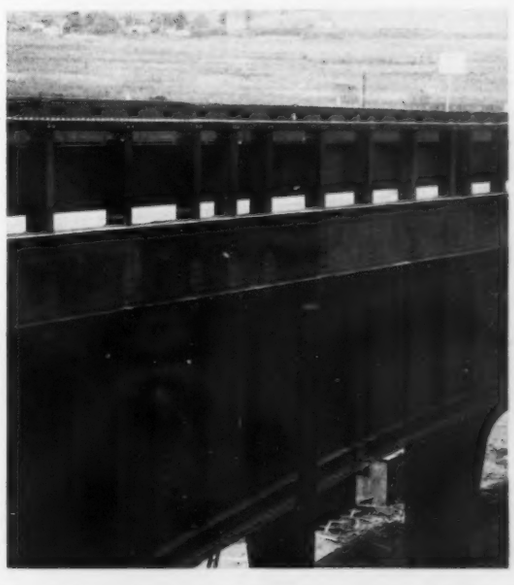
CITY OF NEW YORK, DEPARTMENT OF PARKS, ROBERT MOSES, COMMISSIONER; MADIGAN-HYLAND, ENGINEERS

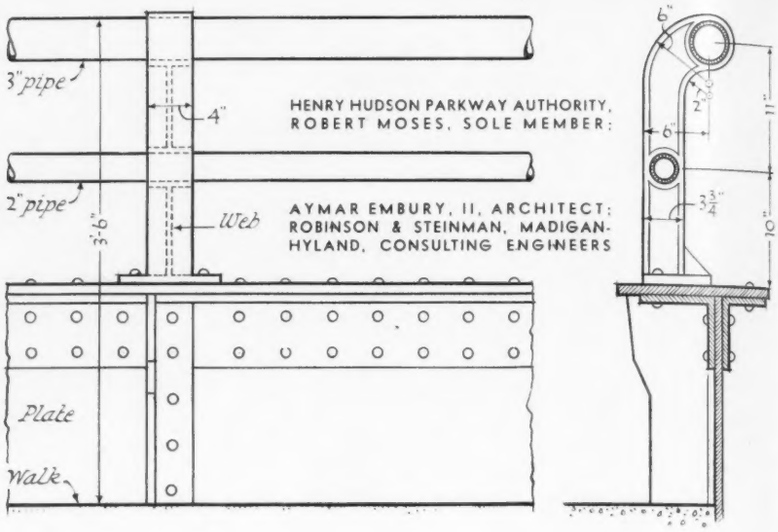
All details 3/4" scale



PORT OF NEW YORK AUTHORITY, J. C. EVANS, CHIEF ENGINEER; AYMAR EMBURY, II, ARCHITECT

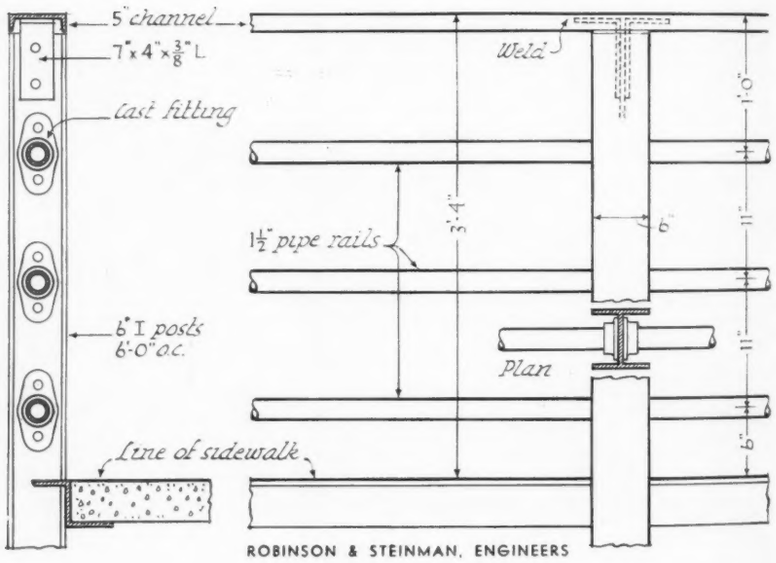




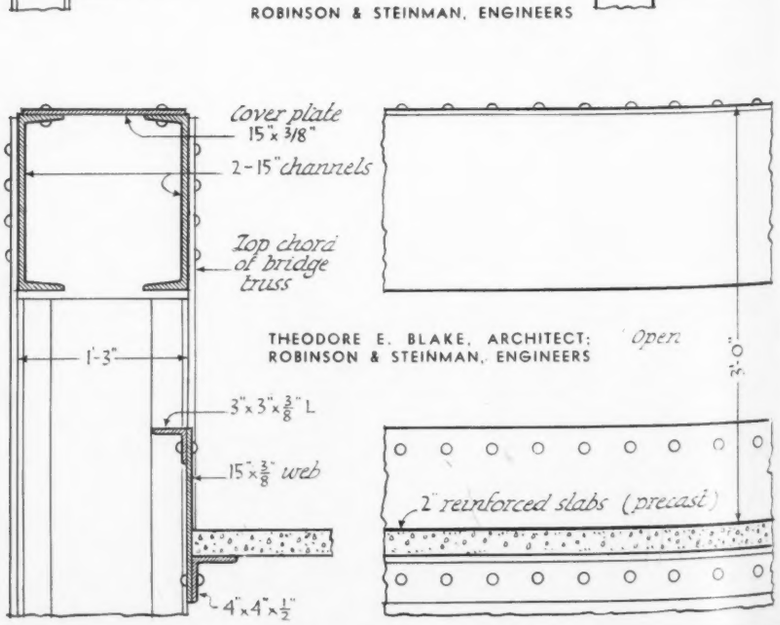


HENRY HUDSON PARKWAY AUTHORITY, ROBERT MOSES, SOLE MEMBER;
AYMAR EMBURY, II, ARCHITECT; ROBINSON & STEINMAN, MADIGAN-HYLAND, CONSULTING ENGINEERS

All details 3/4" scale

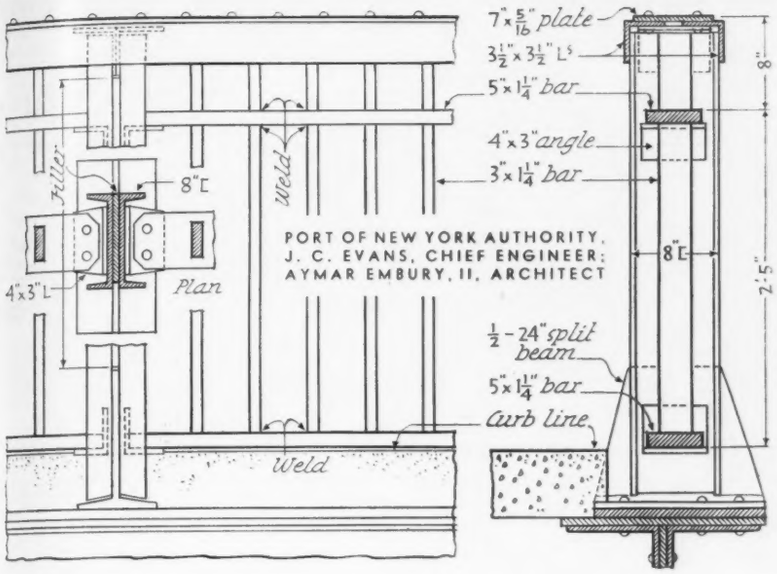


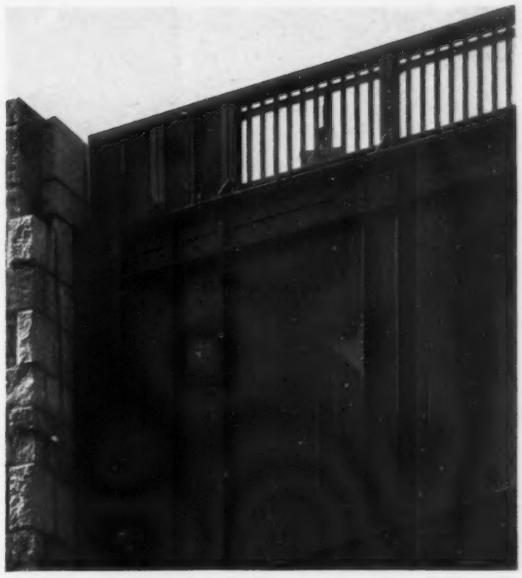
ROBINSON & STEINMAN, ENGINEERS

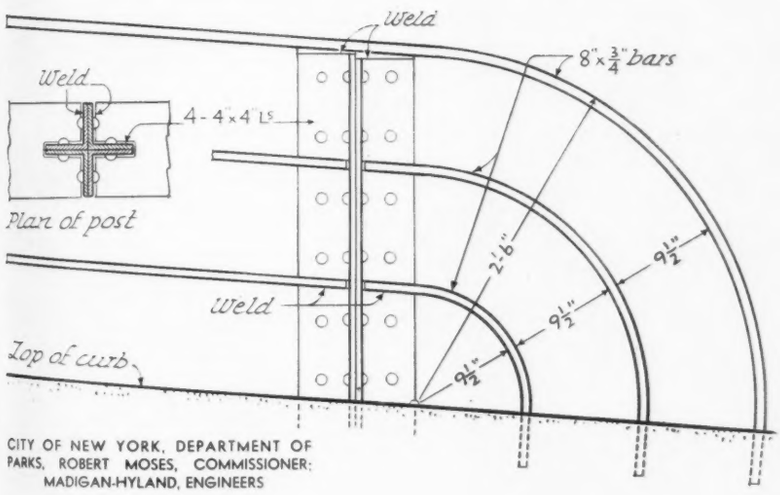


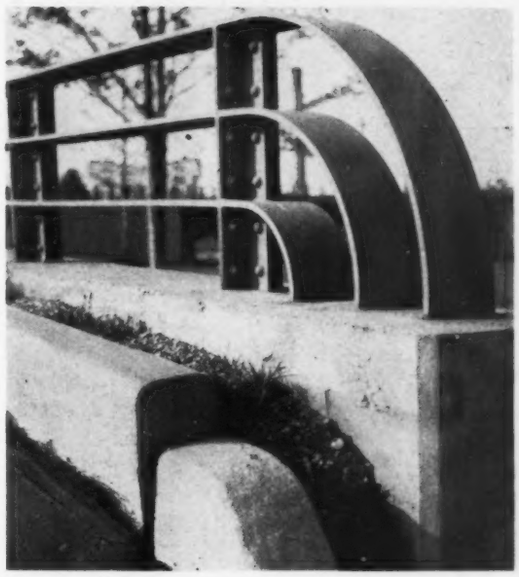
THEODORE E. BLAKE, ARCHITECT; ROBINSON & STEINMAN, ENGINEERS

Open

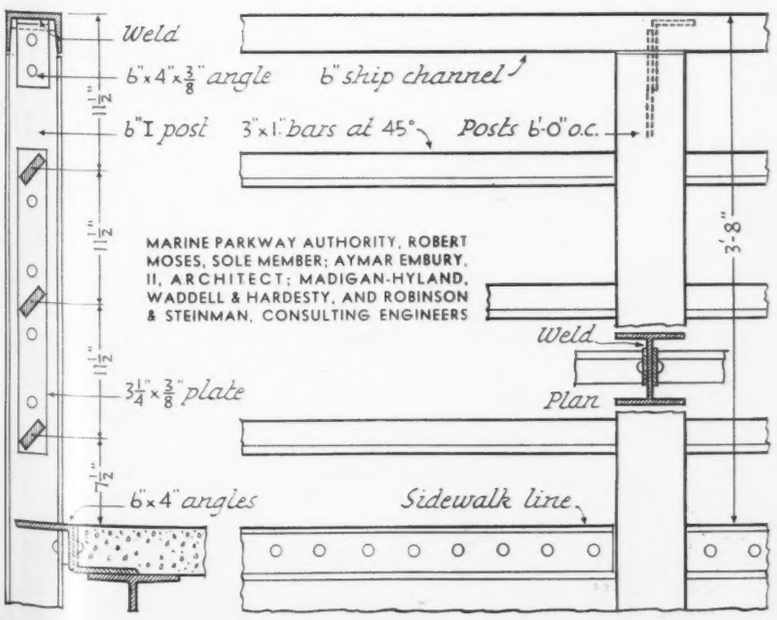


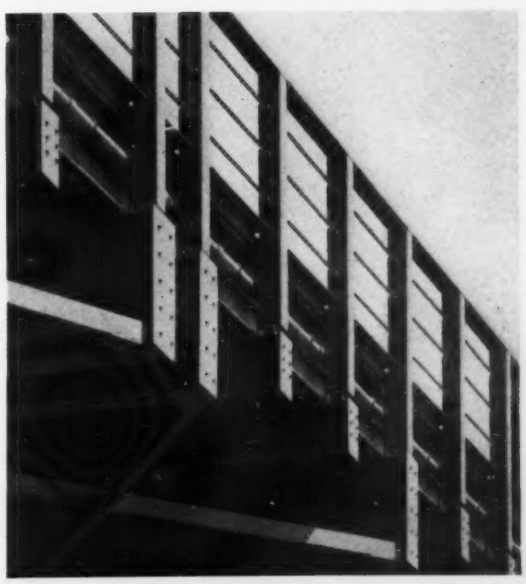


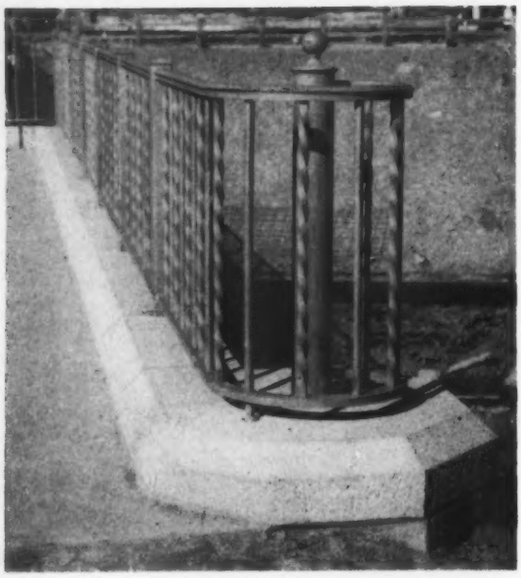


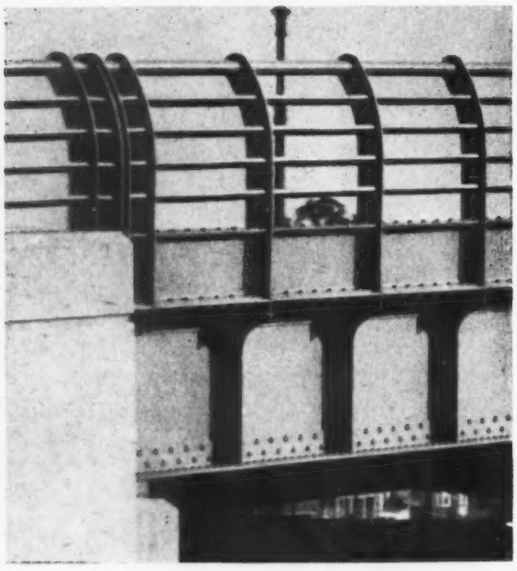


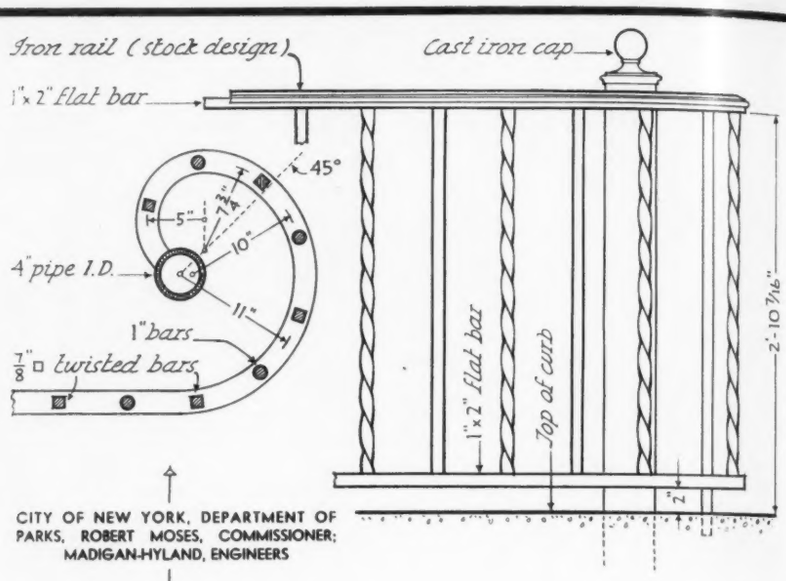
All details 3/4" scale



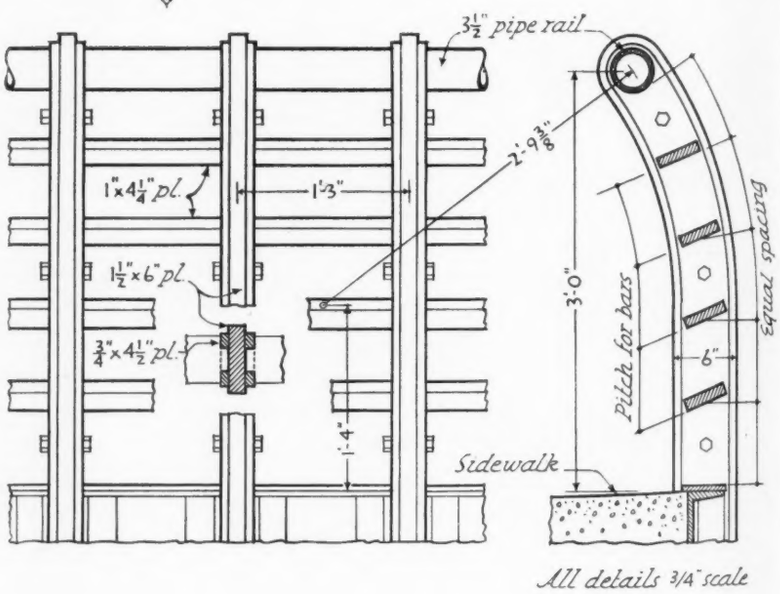




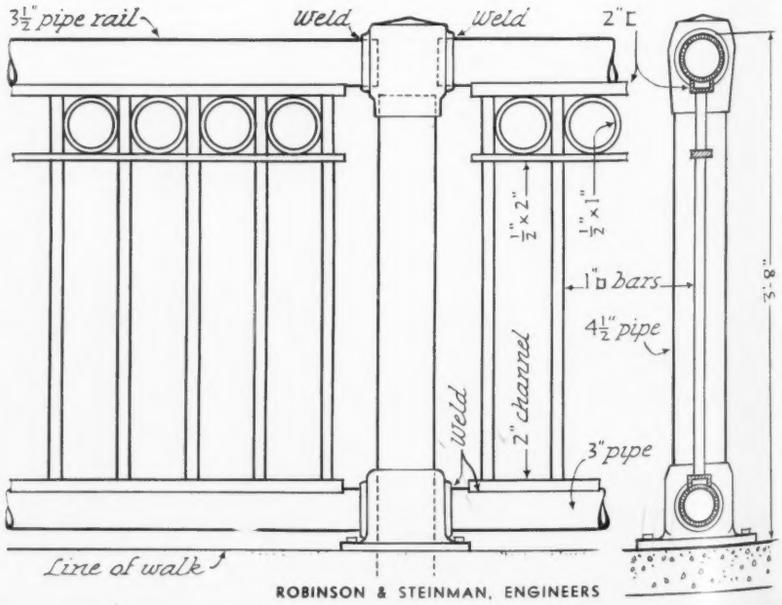




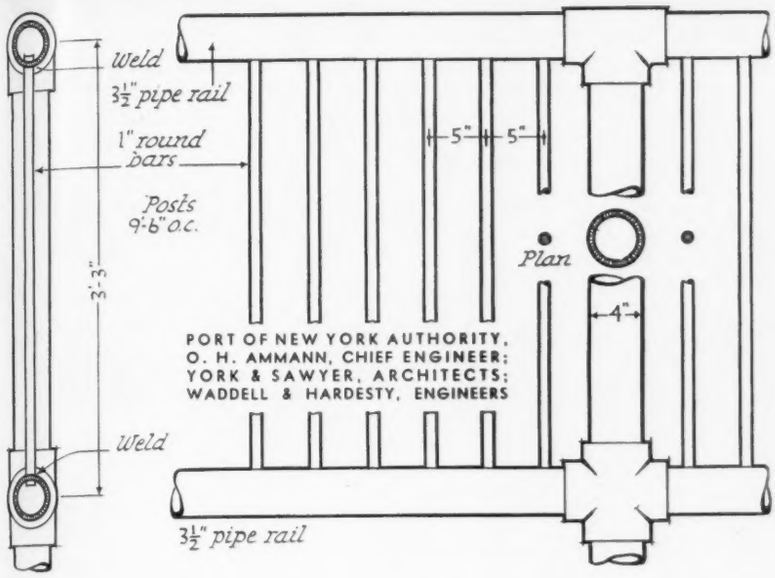
CITY OF NEW YORK, DEPARTMENT OF PARKS, ROBERT MOSES, COMMISSIONER; MADIGAN-HYLAND, ENGINEERS

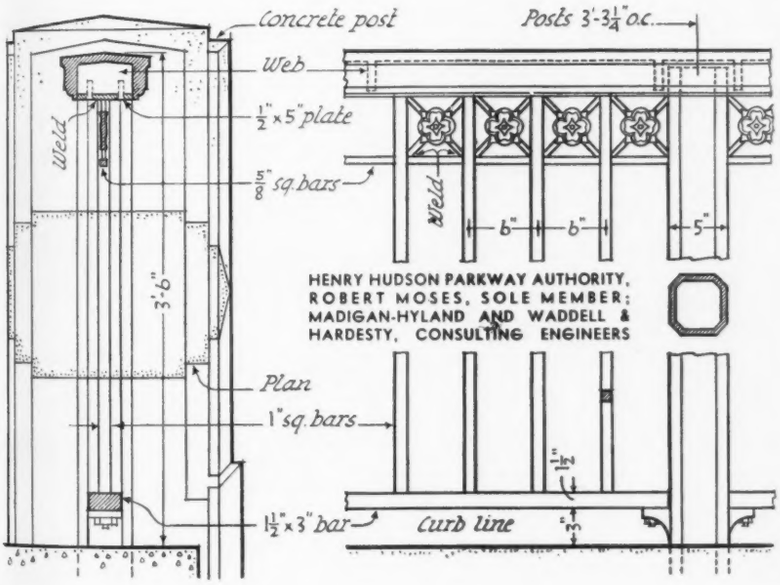


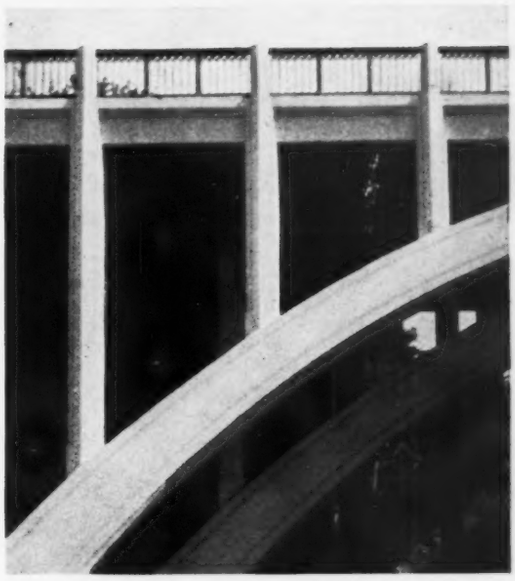
All details 3/4" scale



ROBINSON & STEINMAN, ENGINEERS







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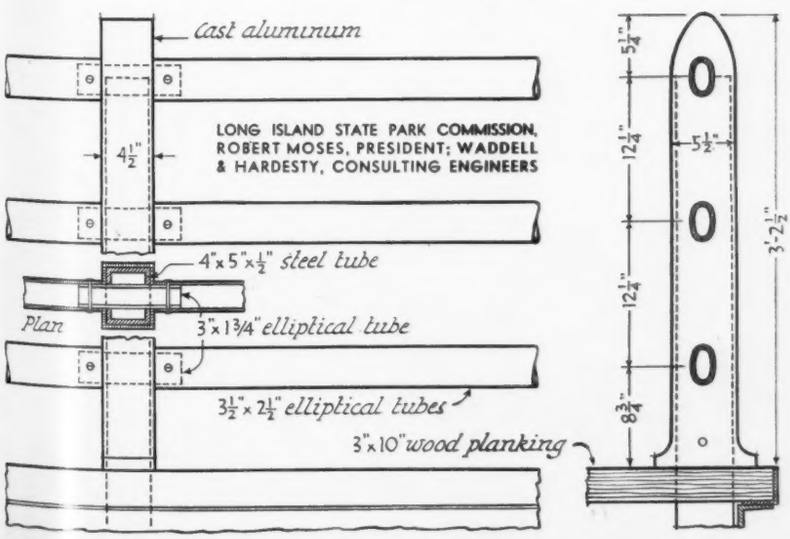

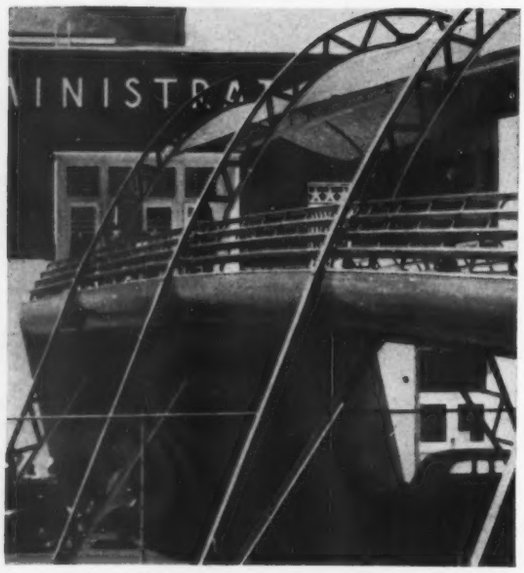

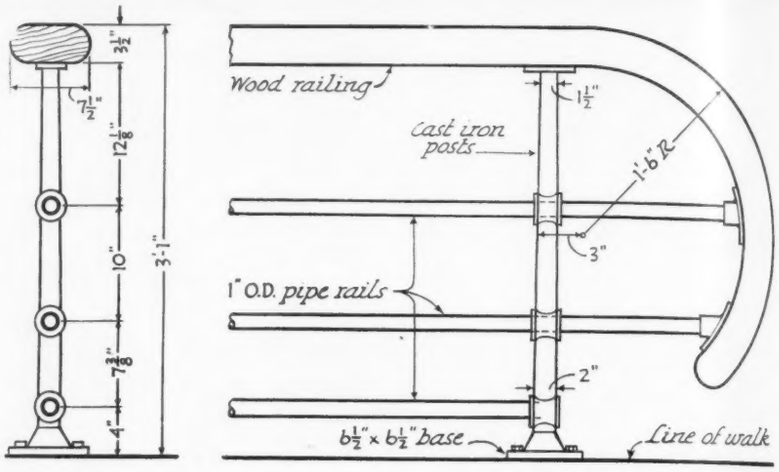

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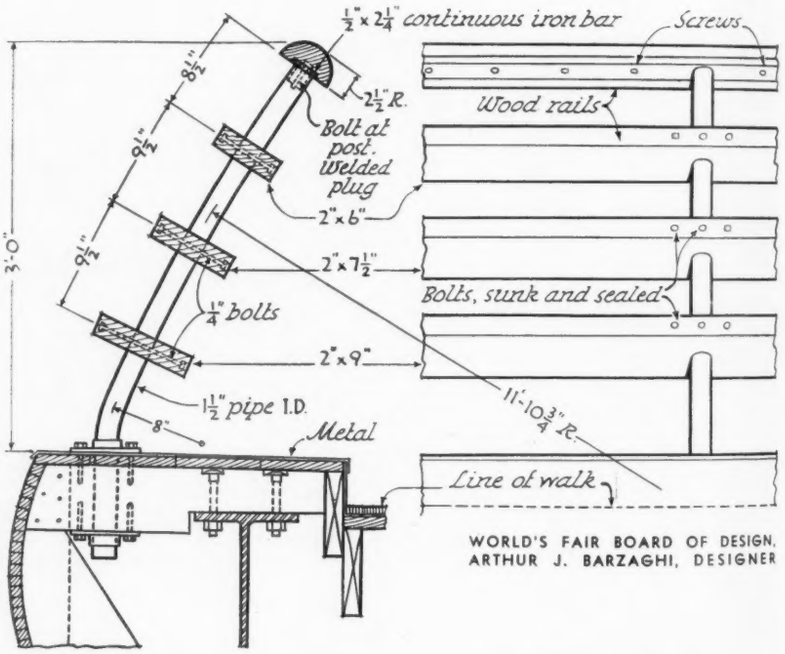
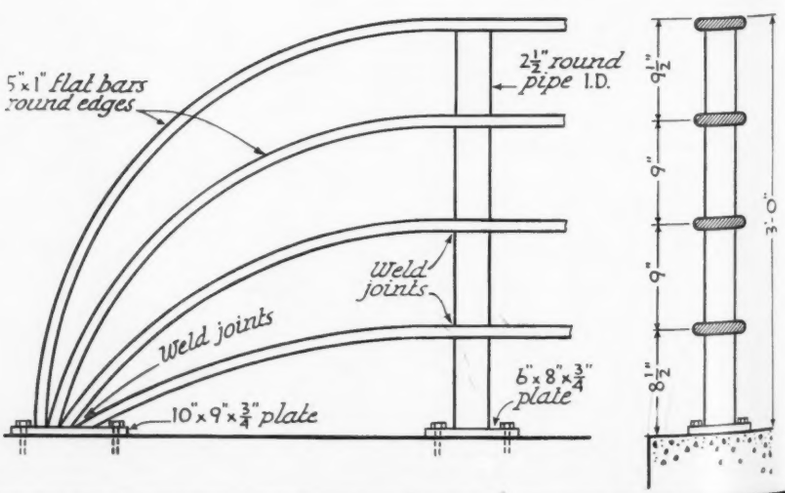
CITY OF NEW YORK, DEPARTMENT OF PARKS, ROBERT MOSES, COMMISSIONER; MADIGAN-HYLAND, ENGINEERS



WORLD'S FAIR BOARD OF DESIGN, ARTHUR J. BARZAGHI, DESIGNER

TRIBOROUGH BRIDGE AUTHORITY; AYMAR EMBURY, II, ARCHITECT



OF SNAILS AND MICE AND EVERYTHING NICE

BY HUBERT G. RIPLEY

An interview by Hubert Ripley with Colonel Fullerton, distinguished archæologist, patron of the Arts, bon vivant, flaneur, and member of the National Geographic Society. The Fullerton Foundation and the Fullerton collection, result of long and painstaking research in many lands from Guatemala to the Coromandel Coast, are recognized as sources of base material for æsthetic expression. When exhausted by his arduous labors, the Colonel finds peace and quiet in occasional visits to his native heath, a suburb of Mashpee, Cape Cod. Here he dreams away the long summer afternoons, alternately scanning a verse from the Zend-Avesta between sips of modest gin and water—his favourite beverage—'til the rising quahaug moon warns him that dinner time draws nigh. Sometimes Dr. Fellows, the Antiquary, joins him for a chat on the Fine Arts, and it was due to his urging that the Colonel decided to attend the 71st Convention of the American Institute of Architects, of which body he has long been a fellow in absentia.

We discovered the noted archæologist one morning in Washington relishing snails at L'Escargot and chatting brightly with Madame la Patronne (which, by the way, is no hardship at all). Beside his plate stood a small bottle of Nuits St. Georges and a basket of the tenderest and crispiest French bread we ever tasted this side of Normandy.

"Did you enjoy the Convention?" we asked. —It was Friday noon, the sun was crossing the yard arm and most of the delegates had departed. "Immensely," replied the Colonel. "Sit down, my boy, and have a Vermouth Cassis. I must talk to somebody." "Go as far as you like, old fellow." We could see he was relaxed, in a mellow mood, so to speak.

"I reached Washington," he began, "just in time to get under the wire for accreditation and enrollment, and consequently missed tea at Dumbarton Oaks and the Reception at the Corcoran. Did see the exhibition of Architecture of the Americas later on, however, and was greatly impressed by the many examples of significant form, particularly some lesser known Spanish Colonial buildings in South America and recent work in the United States. Strangely enough, the Mayan and Inca source material, whose remains to my way of thinking compare favourably with the finest fragments of antiquity found anywhere in the world, is only just beginning after centuries of neglect, to make its influence felt in 'Modern Architecture.'

"You mean in North America?"

"In North, Central and South America, including the Virgin Islands, and San Domingo. A race track structure in the latter place, or maybe it was Uruguay—I've seen so much during the last five days I'm not

sure of anything—was awarded a grand prize by the jury. *Au fond*, it's pure Mayan in conception with the addition of some modern amenities such as cocktail bars, open plumbing, and a shelter roof. The photograph didn't do it justice, so I was told by a tall, dark, distinguished looking gentleman who spoke perfect English. He said one should see it during the racing season filled with fair women and brave men dressed in their sport clothes, wildly cheering the winner of the Grand Prix. 'Your English is perfect,' I told him; and he replied, 'I was educated at the University of Pennsylvania!'

"No awards were made in the United States section, the jury not wishing to be invidious perhaps. I noticed however the United States section was hung in a large well-lighted gallery where it could be seen to the best advantage, while the South American exhibit was strung around casually in an inner corridor on movable frames."

"Tell us about the President's Reception."

"It was a jolly party. Everyone got off to a good start. I've never before seen so many architects and their ladies in one room. The receiving line, headed by our well-loved president, four Past Presidents and their ladies, was an impressive sight. It was amazing to note that the president was able to call by name almost all who shook his hand. Charley Ingham, tall and handsome, who stood beside him, identified those whom the president did not know. There might have been five or six hundred, more or less, who passed in a steady stream from the guarded entrance, down the line to tables groaning with edibles and potables; a marvelous opportunity, if one had the inclination, to catch up with one's steady drinking. 'I always know when I've had enough because I become unconscious,' someone remarked. The Mayflower certainly did us extremely well.

"The opening session on Monday morning was the occasion of an inspiring address by the president. Combining a happy faculty of expression with a penetrating insight into the problems of the profession, Mr. Maginnis' speech was closely followed by the largest assembly at any Institute meeting it has ever been my privilege to attend. In fact, at each session during the past four days (and some of them were dullish in spots) he enlivened the proceedings with a constant stream of sparkling sallies, pungent and pertinent. I wish a verbatim report of all the president said during the four-day meeting might be placed in the hands of every architect. It would not only be fascinating reading, but also a human document worthy of a special niche in one's library.

"Near the end of the meeting, a rather long list of complicated resolutions were under discussion, resolutions the Board or a special committee should have been empowered to pass upon without taking up time that might have been devoted more stimulatingly to cultural matters (a round table discussion at Harvey's, for example), and the delegates became uneasy. This was commented upon and the situation was reviewed at some length by William Lescaze. He spoke winged words which were echoed by others. The discussion must have lasted an hour or more, Mr. Lescaze doing most of the talking; and ended in another resolution! Architects may not care to read, but they certainly like to talk.

"The Banquet was on Wednesday evening; so, shortly after lunch at the Cosmos Club with Frank Sullivan—little necks, welsh rabbit, and green salad washed down with pale ale, one of my favourite noonday repasts, but not for the atrabilarious—I indulged in an afternoon siesta in the quiet of Suite 654. Did I mention the suite? Four of us shared it, the pleasant thing to do at Convention meetings. Uncle Edward and I had one room and two big shots from New York had the other with a large parlor between. Breakfast wheeled in on a cart at eight each morning; we sipped our coffee and talked over events of the previous day and made plans for the present, dressing leisurely the while. By ten we were either ready for whatever the day had to offer; or to go back to bed again, as fancy dictated, safe in the knowledge that if one missed anything of import the others would tell all about it next morning. Uncle Edward always sleeps with a long black silk stocking

THERE IS A STORY TOLD IN WASHINGTON THAT THIS BRONZE BY CARL PAUL JENNEWEIN, BESIDE THE OLD DISTRICT COURT HOUSE, WAS FOUND ONE MORNING GARBED IN GINGHAM. THE LADY'S NUDITY HAD AROUSED A STORM OF CONTROVERSY. PHOTOGRAPH BY EMANUEL ELSNER

over his eyes, partly for sentimental reasons and partly to keep the morning light from awakening him too early.

"Oh, but life went gaily, gaily,
In the house of Idledaily.
There were always jugs of sherry,
Waiting for the makers merry.

"Dressed for the Banquet shortly after six, I strolled down to the lobby and peeked into the Pan-American Room from whence issued inviting sounds of music, gay laughter, and the tinkle of ice cubes. The Pittsburgh Chapter was holding a song fest. Charley Ingham had been kind enough to invite me to be present, so I went in, was most cordially received and given a tall glass to hold. A delightful young man named Robert Schmertz—who, I may say, will some day go far—had just finished a plaintively provocative ditty about Pietro Massimi and his masterly Palazzo, the inspiration of many a millionaire's mansion. Shave off a few dentils and you have a modernistic building like New York State's at the World's Fair. Which only goes to show there's little new under the sun—except the pyramids and Chichen-Itza, of course. Anyhow Bob's ditty was a masterpiece, suavely rendered with banjo accompaniment. Maybe there's room for a sample verse which lists some of the guests at the cocktail party when the Palazzo was finished.

"Pietro's housewarming was quite a success,
And Rome became all of a twitter.
The Pitti, the Pazzi, Ricardi and Strozzi,
The Medici, D'Este, and Borgia came,
Not to mention the proud Pandolfini,
And the swell Davanazati, a trife high-
hatti,
And, of course, Benvenuto Cellini.

"The music is elusive; a melange of 'O'Dooley's First Five o'Clock Tea,' interspersed with wisps of 'Love's Old Sweet Song.' I only wish I might quote it, in toto, for the readers of PENCIL POINTS. Peruzzi would have loved it, I'm sure. Maybe he was listening in that Wednesday afternoon over a short wave from the Elysian Fields."

"How about the Banquet you started to tell us about?"

"I'm coming to that. The banquet committee had, I understand, a complex problem in arranging the order of precedence at the head table. Should the Supreme Court or the State Department sit at the President's right? In what order should distinguished delegates from foreign countries be placed? These things are, or seem to be, vital in the Nation's Capital. Edmund Purves and the Maitre d'Hôtel of the Mayflower had arranged the menu in masterly style that left little to be desired. The Ball Room was filled to capacity. I don't see how another table could possibly have been managed. The President of the Institute was again in a happy vein, retailing stories of his early days, mingling wit and pathos with just the right touch, holding his convives in merry mood, now gay, now serious. The fair sex was well represented, brilliant, sparkling. A more distinguished gathering would be difficult to conceive."

"When the Banquet was over what happened?" we asked, for we realized that among seven or eight hundred people all dressed up there must be some who wanted to go places.

"Some went mouse-hunting and some had biscuits and cheese in various spots. They say there are lots of night clubs in Washington that merrymakers like to close up. Then there are always parties in the spacious Mayflower suites that continue into the small hours. We all turned in early, around two'ish, after discussing Art and Life over a glass—well, maybe two or three—of gin and tonic."

"Just what is mouse-hunting?"

"Excuse me a minute, my boy, I see someone just leaving I must speak with." The Colonel disappeared for a few minutes. When he returned, he'd forgotten about the question and we didn't press him for the answer.

"Thursday's sessions," he continued, "were most interesting of all. Had it not been en-

livened by the president's shafts of ready repartee to question and comment from the floor, the morning might easily have been a dull one. The afternoon session was most inspiring, a model for future emulation; the ceremonies attending the presentation of certificates of Fellowship and Honorary Membership were conducted in happy vein; Nathan Strauss' response being especially notable, receiving a fitting ovation. The installation of new officers and directors was preceded by a spontaneous and almost overwhelming tribute to Charles D. Maginnis, who has so ably presided over the destinies of the Institute since June 1937. The great Ball Room of the Mayflower must still ring with the echoes of thunderous plaudits.

"Edwin Bergstrom, of Los Angeles, modest and retiring, is the new president. His long and faithful service in the affairs of the Institute has kept alight through tragic years the divine spark on the altars of the Muses who dwell in high Olympus. A worthy recognition of his unselfish devotion to the interests of the whole profession. In a short address, thoughtful and impressive, he outlined briefly his policies for the future, touching on the problems that confront those who serve the Arts and Sciences. Alluding to his predecessor, he said in substance: 'Mr. Maginnis has told you how deeply he has appreciated the privilege of his work and association with the Board of Directors, and the members of the Institute. I wish I had his happy faculty of expression that I might fitly characterize *our* appreciation of association with *him*.'

"The Institute is to be congratulated in having such leaders. *Ave atque vale, praeses!*"

The Colonel, who can eat and talk at the same time, had finished his snails and arose from the table, announcing he was off for New York and the World's Fair.

"We're just going too. Won't you join our party?"

"Willingly," he assented, "I'd love to finish my talk with Uncle Edward about his early days on the Ohio. They say his collection of Indian arrow heads is unique."

So we all motored to the Great City, stopping at Newcastle on the way to steady our nerves with brief glimpses of the serene old town and to quaff a dish of tea in the Assembly Hall. The week-end was misty with frequent sputters of rain. Architects' Day at the Fair was bleak, cold and wet, nevertheless night effects, color, light, fireworks, filled us with undimmed enthusiasm.

In this mood we made directly for the Masterpieces of Art Museum, wherein are to be seen examples from the World's great collections. Eight centuries of painting, arranged in chronological order, are on display. Twenty-five galleries are hung with a thousand or more works of the divine masters of the Renaissance, dating from its early beginnings to the close of the XVIIIth century, and form a collection unparalleled in museum annals. For three hours we basked contentedly in the companionship of the truly great.

> *Have little care that Life is brief,*
> *And less that Art is long.*
> *Success is in the silences*
> *Though Fame is in the Song.*
> *(Songs from Vagabondia.)*

Our favourite building, the French Pavilion, was superb on Saturday night, a wonderful place from which to view the ever-changing chiaroscuro in the Lagoon below the terrace. We saw John Cady perched on a streamlined stool beside the bar discussing a Pernod. ($1.03 the pair.) Unfortunately the surging crowd swallowed us both and we missed some of his pithy comment. The Perisphere was looking her best in an opal evening gown trimmed with deep purple ruching bordered with pale rhubarb, like a gay Salamine. Two of the best façades were in the power section where great sheets of water tumbled between columns of rich ultramarine, extending from the pool below clear to the roof with only a thin line to show where the sky begins. Nearby was a puzzling structure of corrugated iron, not exactly a building, and yet one could doubtless go inside if one was in the mood. The exterior appearance was like a more or less

orderly collection of giant snow plows, such as one sees in the upper reaches of the Rocky Mountains. The water façades were fascinating and we studied them for some time. They seemed to melt into the landscape and meld with the flanking planting, beautifully done. It finally dawned on us that these aquatic structures support Ken Murchison's thesis that the architect is one-third plumber.

This reminded the Colonel of a story Harry Cunningham told him in Washington about some new buildings at Washington University. Until further appropriations are available, the exterior facings of limestone or brick and interior plastering have been omitted. A lot of piping that will eventually be buried in the masonry, now runs outside the walls—Y's, T's, and hubs all exposed naked to the breezes. This didn't look very pretty, so they painted the walls and piping white. While this helped some, the irregularity of the plumbing system was still rather *quelconque;* so on the next building the piping and conduits were run in orderly parallel lines, with screw joints, nipples, etc., replacing the Y's, T's, and angle bends, just as if Norman Bel Geddes—not to be confused with J. Peter Geddes, II, distinguished Providence practitioner—had designed it. After experimenting with various color schemes, a tender green, the exact shade of the under side of an olive leaf rather than a white, gave the most pleasing result. "Now," Harry concluded, "the coeds may view *les feuilles a l'envers* without going out into the country."

Colonel Fullerton liked the Italian Building. He didn't mind a mighty statue poised above a waterfall, and was amazed that one could go behind the scenes and look through plate glass at falling water on the front, then turn around where today's menu was posted beside the entrance doors and read: "Roast Guinea Hen, $5.00." It was the wedding of Art and Industry.

Once one gets accustomed to exotic things, the Brazilian Building begins to shape up naturally enough. The garden side is endowed with suave grace, flowing serenely into the eurythmic shrubbery and pools set off by gay tables and umbrellas where one may seek peace and sustenance. The waterlilies and great lotus plants seemed part of the architecture.

"For lands sakes, I really believe I'm beginning to appreciate the full significance of the 'flow of space,' " remarked the Colonel.

Before leaving New York we took the Colonel to see the new building that houses the Museum of Modern Art, just as a test. The old gaffer stood up bravely under the strain, whispering, "It's a frozen waterfall! My word, what a window! Does it open?"

"Want to step inside and see?"

"N-n-no; later on, perhaps. I'm all pepped up as it is and mustn't overdo—there's a limit, my boy you know. Who's the architect?"

"Eddie Stone's one of them. How do you like it?"

"I like it the way Grandma Lowett liked mushrooms. Grandma once said she was very fond of mushrooms but didn't like them well enough to eat 'em!"

"Any further comment before we leave? We've a little shopping to do at Park and Tilford's. In case of a seizure on the road, you remember some States are dry on Sundays."

"Yes, I remember," he sighed feelingly. "A comment on the Museum? Let's call it the Eddystone Lighthouse."

On the way to the station our taxi, held by the traffic lights at a cross street, drew up close beside another in which sat a distinguished looking couple. The man was evidently making a train we gathered, and the taxi cabs almost touching we couldn't help overhearing a little conversation: "I think I'd better wipe off some of this lip stick before you kiss me good-by," said the dark lady of the Sonnets. "Here, take my handkerchief," said her companion. "No, no, no! I mustn't do that! Don't you realize that many a divorce case has been decided on the evidence of lip stick on a man's handkerchief?"

CONSTRVCTION WITH PLYWOOD

BY OSCAR FISHER

The economic desirability of building with larger units to reduce the number of construction operations has encouraged the production of a variety of panel materials. Of these, plywood is extremely important. Many ingenious methods, utilizing plywood in new or improved ways, are being developed. The laminated construction of Egyptian mummy cases has been revived after thousands of years and is again being utilized in even more permanent and versatile fashion today. The history of plywood and its extensive use is far more impressive than is commonly supposed.

Out of a welter of discussion and theorizing, a sound approach to the utilization of plywood in permanent construction has emerged. Somewhere between the breathless watcher for a material which will make it possible to blow a house as one would a bubble, and the "ostrich," who would still have us living in mud huts, caves, and log cabins; we have the inevitable developer of new materials and methods, who combines the good of the old and the new and rejects the bad of both.

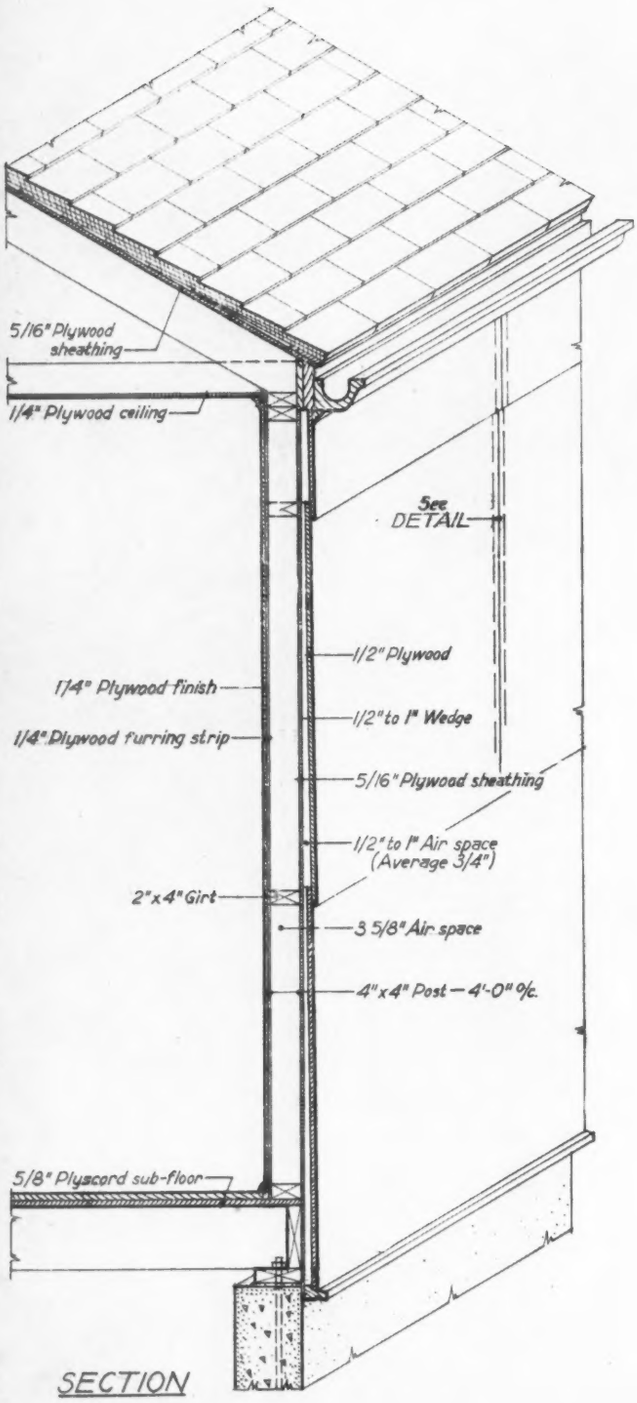
Natural wood may have twenty times as much tensile strength along the grain as across it. It may swell and shrink thirty times as much across the grain as it will along the grain with changes in moisture content. These variations furnish the reason for twisting and settling—and myriad complicated complaints against wood, when these factors are not carefully considered in the design of a structure.

Due to the crossband construction of plywood, the differential of movement along and across the grain and the differential of strength in compression and tension are equalized. Thus wood, which has the greatest strength of any material per unit of weight if stressed along the grain, has had its crossgrain weakness eliminated. With the variable factors thus reduced a few simple precautions in design will eliminate entirely any possible danger from swelling, shrinkage, or inequalities of strength.

Five years ago the application in quantity production methods of a synthetic resin binder made a perfectly waterproof plywood generally available. In the short time since, hundreds of houses, boats, and airplanes, employing dozens of new structural systems, have been built with this new plywood. Much has been learned respecting proper methods of construction. Plywood may be designed with engineering exactitude. One of the most temperamental of building materials has become one of the most docile and predictable.

The beauty of hundreds of different woods in plywood is at the disposal of the interior designer. Rare and exotic woods may be obtained at a relatively low cost. Used as solid panels, many of these woods would not be durable, although very expensive. But as the face veneer on plywood, where the core is of sturdy and inexpensive woods, any of them can be safely and economically used. Other plywoods have been developed to high suitability for structural use and exterior finishing.

Large expanses of unbroken surface are possible in plywood, due to the method of "unrolling" a log against a knife which cuts



BESIDES THE DOUBLE PLYWOOD WALL CONSTRUCTION SHOWN ABOVE, THERE ARE OTHER POSSIBLE VARIATIONS. THE SHEATHING LAYER MAY BE OMITTED, AND VARIOUS JOINTS USED TO PRODUCE A FLUSH EXTERIOR

a continuous veneer 1/32" to ¼" or more in thickness. This is the most common method for cutting veneers for plywood and is called "rotary cut." Other methods are used for special grain effects. When the log is squared and moves against a knife to produce a sheet of veneer from its entire length, the method is called "slicing." "Sawing" is the method used to produce quartered rough-sawn and plain-sawn grains.

The curving of solid wood was rarely attempted since it was not a true expression of the nature of the material. Plywood, on the other hand, violates no æsthetic convictions when it is used in this manner. There are five methods of securing curves in plywood.

First—plywood may be soaked in water. It is the opinion of qualified research men that wetting plywood to bend it, except in the case of waterproof adhesives, is a frequent cause of trouble. The usual technique is to keep the plywood moist for 24 hours after which bending pressure is applied in successive stages against forms of the desired radius.

Second—steaming is another method for bending plywood. Water-resistant and waterproof-glued plywood may be steamed and bent to comparatively small radii in a manner similar to wetting.

Third—saw-kerfing is a method frequently used. Any thickness of plywood may be bent to practically any radius by saw-kerfing the back to relieve the cross-band resistance. The frequency of the kerfing depends on the radius desired and the thickness of the plywood. If the kerfing is properly done, no marks will appear on the face of the curved panel. But if the kerfing is too deep or spaced too far apart, the face of the panel will show bend marks.

Fourth—some manufacturers have offered bending panels about ⅛" in thickness, consisting of only 2 plys. By omitting the ply on the back, the stress is relieved so that curves of almost any radius can be obtained. Two-ply plywood, however, is an unbalanced plywood and some "brute force" method of keeping the material in tension is necessary. Two-ply bending panels, if

used, should be glued to a solid backing to hold it in shape. It is used successfully in furniture.

Fifth — plywood without any treatment whatever may be bent by securing one edge and forcing it into templet shaped framing, nailing it in place as it takes the desired form. This is the method most commonly employed in form work and is equally adaptable to interior finish. The following table gives the minimum radii to which plywood panels of various thicknesses can be bent. The terms *lengthwise* and *crosswise* refer to the direction of the face grain.

3-ply

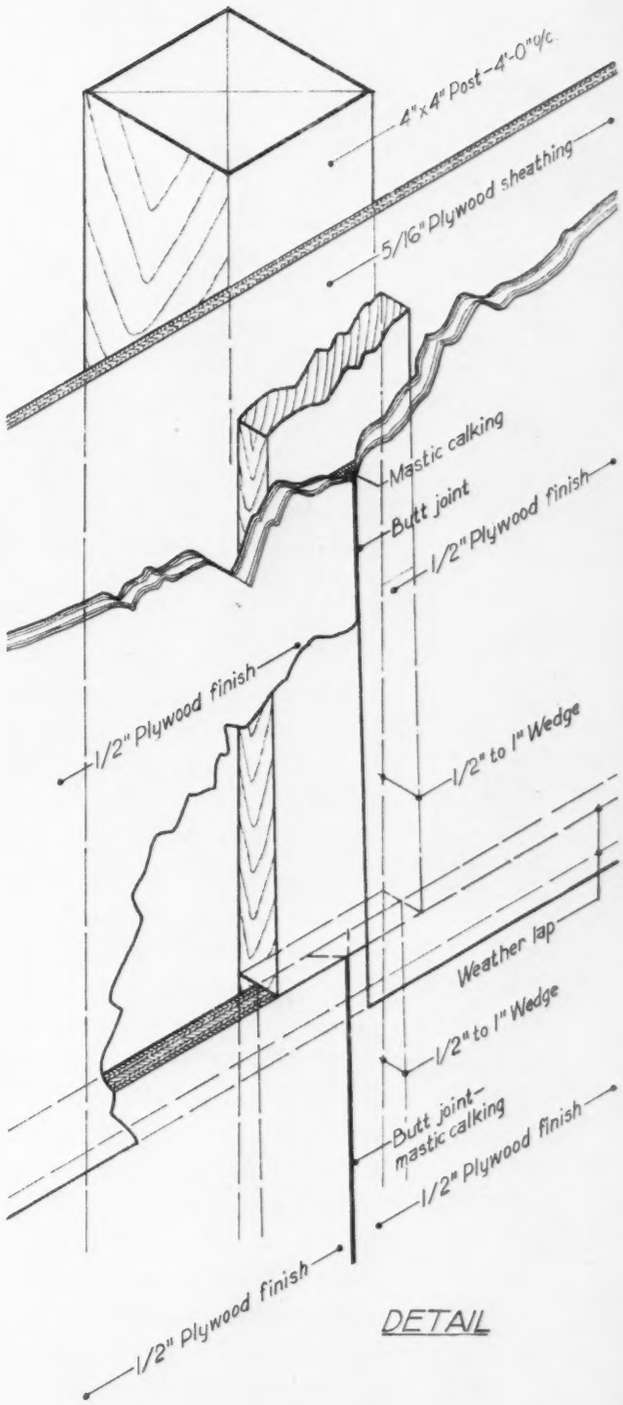
1/4" lengthwise	2'-0"
1/4" crosswise	1'-3"
3/8" lengthwise	4'-6"
3/8" crosswise	3'-0"

5-ply

1/2" lengthwise	8'-0"
1/2" crosswise	6'-0"
5/8" lengthwise	10'-0"
5/8" crosswise	8'-0"
3/4" lengthwise	12'-0"
3/4" crosswise	10'-0"

At this point it might be well to distinguish between the terms "veneer work" and "plywood." Etymologically, the way these words are used in the industry would be hard to justify. However, the term *veneer work* is considered by practicing plywood men to mean small volume or custom work wherein veneers of relatively rare or expensive woods are applied to a laminated or solid wood backing, with considerable emphasis on the æsthetic result. The woods used to produce veneer work are generally hardwoods although some of the rarer softwoods are also employed. The United States Department of Commerce, in "Commercial Standard CS35-31," have published the accepted and approved commercial standard applying to some hardwoods and Eastern Red Cedar.

The term *plywood* is looked upon as the name for a mass production material, standardized as to size, use and grade and with recognized structural, insulation, and decorative values. Plywood implies less empha-



THE DOUBLE PLYWOOD WALL CONSTRUCTION RESULTS IN ERECTION ECONOMY, GREAT STRENGTH, SATISFACTORY RESISTANCE TO HEAT LOSS, AND PROTECTION FROM THE ELEMENTS. FULL WALL SECTION OPPOSITE

sis on the æsthetic than does the term "veneer work."

In this article, it should be noted, the word "plywood" is used generically to refer to both varieties.

For the purpose of this article it is desirable to subdivide the subject of Plywood into the main classifications of its use:

1. Plywood used as an interior finishing material. Here its main use is for wall paneling, wainscots, ceilings, and cabinet-work.
2. Plywood used as a labor-saving medium. This classification includes the use of plywood for concrete forms, sub-flooring and sheathing, and as a base for linoleum.
3. Plywood used as an exterior finishing material. Included here is the use of plywood in the same manner as such conventional siding materials as clapboards, shingles, stucco, flush boarding, etc. This also includes plywood used in structural systems which depend upon plywood for structural strength and for finish on the exterior or both exterior and interior.

We will concern ourselves with general information rather than with details in each of the above categories.

Plywood Used as Interior Finishing Material. One of the earliest carpenters' handbooks written, dealt with instructions for building paneled rooms and furniture with veneered wood. Many of the best examples of old paneled interiors are monuments to the veneer worker's artistry. Few realize that the commercial plywoods of today are simply a development of the superb craftsmanship of the ancient and honorable art of the veneer worker. In fact veneering enjoyed the highest repute until a reaction set in against the mid-Victorian monstrosities, many of which had been made of veneers. The reaction proved a boon, in that it gave the veneer manufacturer time for meditation and out of this breathing period came the modern application of veneering to produce the new, engineered plywood.

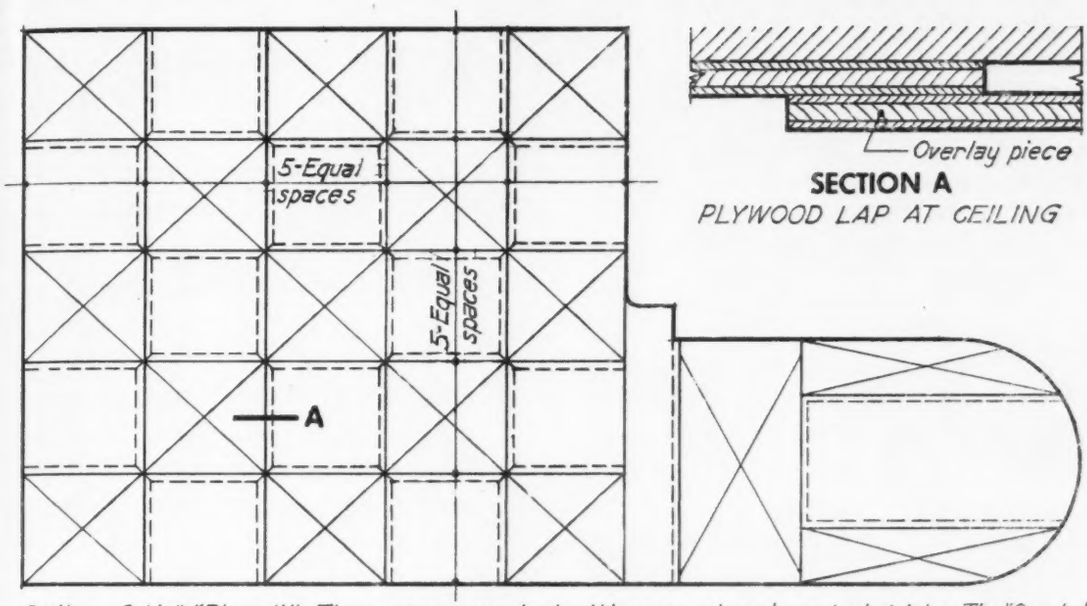
The old paneled library of solid wood had joints—but in designing the library the inevitability of the swelling and shrinkage of wood was taken for granted and reckoned with. Moldings covered slip joints which were left apart expressly to allow for this movement. This type of construction was absolutely satisfactory as attested by extant examples in perfect condition. With modern plywood this method is equally satisfactory and safe.

Plywood, in either hard or soft wood faces, also offers a solution to the problem of creating simple interiors with large, virtually unbroken surfaces. Until a short time ago it was considered necessary to leave panels far enough apart to allow for expansion and to cover the joint with unsightly batten strips, or to close them with a filler which could not be successfully disguised. Study of the possible movement of both the plywood itself and the structural frame has made it possible to produce the effects desired by a variety of means.

There are three factors to consider when designing for a continuous wall effect: the swelling of the plywood itself; the movement of the structural frame; and ply-separation. Ply-separation has become impossible since the introduction of modern adhesives. Some of the trouble with joints, attributed to plywood, has been due to movement of the frame. The effect of frame movement may be minimized by taking simple precautions.

Most framing lumber is now properly seasoned and leaves the mill with a moisture content which approximates average conditions in use. Since wood is a live material, however, it will continue to absorb and release moisture alternately. This results in changes in dimension and causes the whole frame of a house to move slightly with changes in relative humidity. Many who have been mystified by recurring plaster cracks and opening of trim joints can trace their troubles to this same source.

Plywood erected by gluing to strips of the same material will remain unaffected by the frame movement. In essence the individual plywood panels are welded into one unit and the finish plywood on an entire wall becomes a single unit. The furring strips are



Ceiling of 1/4" "Plywall". Those pieces marked with cross placed against joists. The "Overlay" pieces then applied on ceiling with lapped joints. Joists furred as necessary.

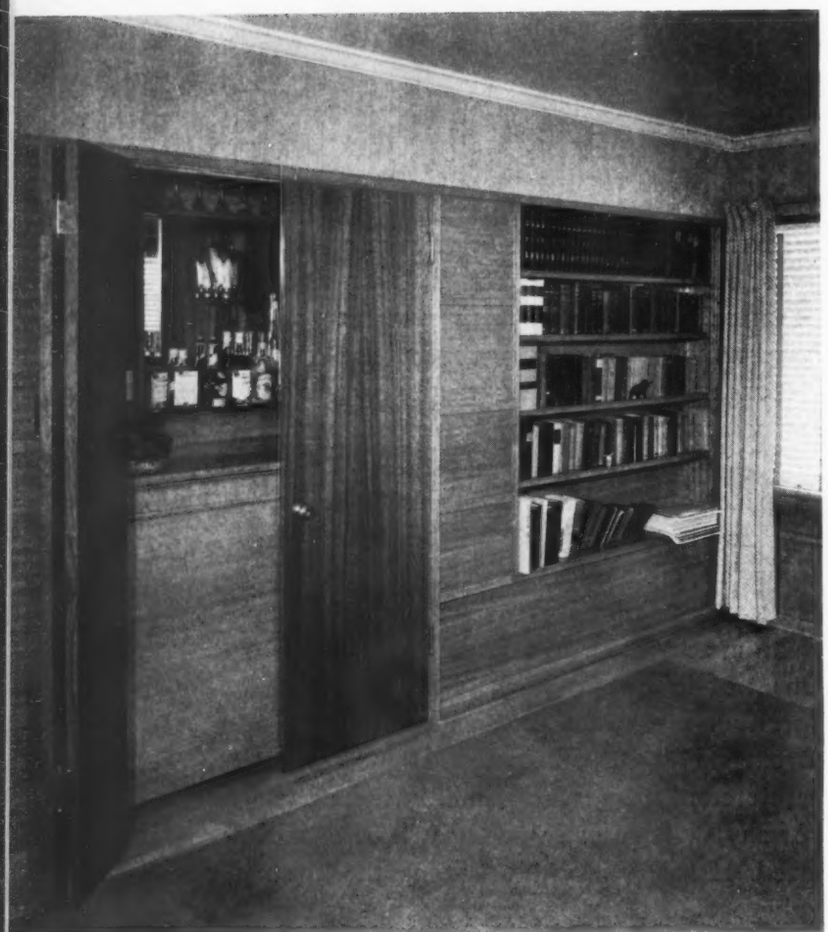
nailed to the frame. Since the nails will give easier than the glue, the frame is permitted to move behind the finish without affecting the surface or the joints. Thus, joint movement due to frame movement is entirely eliminated.

The remaining factor, that of expansion of the plywood itself, is a simple matter to overcome if the nature of the material is given consideration. While the crossband construction of plywood minimizes and tends to equalize expansion and strength, it does not lose entirely the essential characteristics of wood. Wood shrinks most in the direction of the annual growth rings (tangentially), about one-half to two-thirds as much across these rings (radially), and very little, as a rule, along the grain (longitudinally). For ¼" plywood it is reduced to 67/100ths along the face grain and 45/100ths across the face grain. Thicker plywood with more plys reduces these factors to a negligible amount. Simple arithmetic will show that the possible extent of expansion in a stock ¼" thick, four-foot by eight-foot, panel is approximately the same in the eight-foot direction as in the four-foot cross-grain direction. Hence if we allow for the same movement in both directions we will be safe.

IN THE PLYWOOD HOUSE AT THE NEW YORK WORLD'S FAIR, ARCHITECT A. LAWRENCE KOCHER HAS PRODUCED AN EXTREMELY INTERESTING CEILING TREATMENT. ALL THE PIECES NEEDED TO FINISH THE CEILING CAN BE MACHINE CUT AND ERECTION IS SIMPLE

A panel of Douglas Fir ¼ inch plywood will swell approximately 3/16 inches across four feet, from oven dry to saturation. This extreme condition, of course, is never met with in actual use. If we allow for a movement of half that amount, i.e. 3/32 inches per four-foot panel, the danger of buckling from swelling is eliminated. If the panels are erected in average humidity the effects of any swelling or shrinking will be equalized. If the technique of gluing the finish plywood to plywood furring strips is employed, the movement from swelling and shrinkage is transmitted to the ends of the wall and need not be provided for between panels, but allowance must be made for movement at the corners, window and door casings, and ceiling and base molds. This is easily taken care of by utilizing ordinary stock trim, or special details if desired.

If plywood ever buckles it is because these factors have not been considered in its application. If ordinary precautions are taken,



there need be no trouble from this source.

Plywood Used as a Labor Saving Medium. Concrete form panels are made of Douglas fir in standard sizes up to four-foot by eight-foot, and up to ¾ inch thick. They have a great many advantages over ordinary wood forms. First and most important is the reduction in construction time and costs. Estimates of labor saving in the job have been placed as high as fifty per cent. Another saving comes from the hundred per cent covering quality of plywood. Ordinarily it is necessary to figure one-third waste of materials used for concrete forms. The same plywood panels may be re-used many times. One manufacturer has records of one hundred re-uses, and says that thirty or forty re-uses are not uncommon. When these factors are added to the saving of labor time used in cutting other materials, a substantial saving results from the use of plywood for concrete forms.

Additional advantages are (a) the possibility of achieving smooth surfaces with a minimum of treatment, (b) its high salvage value in residence work, i.e. the same plywood which has been used as forms for the foundation walls can be re-used to provide excellent sub-flooring or sheathing, (c) the ease with which plywood may be bent into a variety of shapes for curved walls, etc.

Panels for concrete forms are specified as impregnated with oil at the mill or resin-sealed, as this will insure a completely water-tight panel and thus maintain the water-cement ratio of the mix.

As a material for sheathing and sub-flooring, plywood has many decided virtues. According to job experience four-foot by eight-foot plywood panels may be erected

WITH EQUAL FACILITY, PLYWOOD LENDS ITSELF TO BOTH CONVENTIONAL AND MODERN TREATMENT. THE UPPER PHOTOGRAPH SHOWS A KNOTTY RED CEDAR INTERIOR. PHILIPPINE MAHOGANY PLYWOOD IS USED IN THE MODERN ROOM SHOWN IN THE CENTER PHOTOGRAPH . . . THE USE OF PLYWOOD IN BOAT CONSTRUCTION IS WIDESPREAD, AND DEMONSTRATES ITS EXTREME STRENGTH, FLEXIBILITY AND WATERPROOF QUALITIES

in half the time that it takes to apply one-inch by eight-inch sheathing. On both subflooring and sheathing, one-third of the material is ordinarily wasted. This waste is eliminated when plywood is used. Not only the cost of labor is saved but time is saved at a crucial period when rapid closing in of the building may prevent considerable delay in total construction time.

According to the U. S. Forest Products Laboratory, 5/16″ plywood makes a stud framed wall forty per cent more rigid than one diagonally sheathed with ordinary sheathing. If 5/16″ plywood sheathing is used, it is highly desirable that furring be applied over it horizontally to receive the siding or shingles. This will make it possible to use stock window and door frames. At the same time it will provide an additional air-space and thus increase the insulating value of the total wall construction. Tests have indicated that 5/16″ plywood has greater nail holding power than 25/32″ sheathing. However, one manufacturer has stated that his company prefers to recommend the 3/8″ thickness for the best construction. It therefore is an excellent material for the application of shingles.

Plywood as a Waterproof Finishing Material for the Exterior. The search for a material which makes large unbroken surfaces possible for exterior walls has led the designer into the use of many new materials. Each has its merits and its disadvantages, and each presents a variety of problems in construction and design.

Building with a single material has obvious advantages. The most permanent types of construction in the past have always utilized a minimum number. Each material has a differing coefficient of strength, reaction to climatic conditions, and durability. Myriad chemical and physical reactions are introduced into a building with the addition of each new material. When water comes into contact with wood, the material swells; with steel, the material rusts. Water wears away stone, and sets up complicated reactions in and between different materials. It is obvious that structural simplicity dictates the choice of as near homogeneous construction as possible. Choose steel for steel frames; wood for wood frames; plaster for masonry. From this choice, æsthetic superiority, too, is more apt to result.

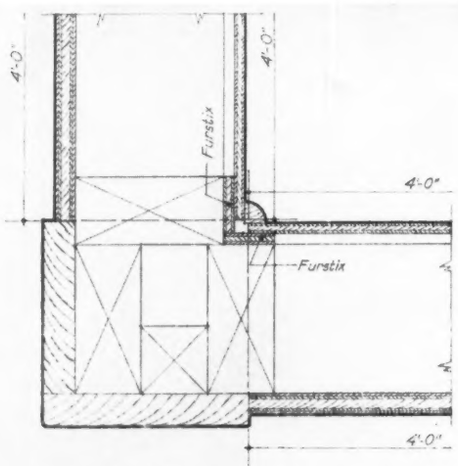
Plywood is an ideal finish for a wood frame. Much of the fine joinery used in wood construction today was first developed by boat builders. It is significant that they were also among the first to utilize the new waterproof plywood. It seems that the wider horizons of the sea stimulate original thinking. The early Americans brought back to their seaside cottages the same kind of efficient planning and sturdy construction that they put into their boats. House designers are again learning from shipbuilders.

The recent acceptance by the Federal Housing Administration of plywood for uses heretofore not sanctioned has created a new interest in plywood construction and will do a great deal to accelerate its widespread use. The requirements of the FHA are based on the U. S. Department of Commerce's terminology, definitions, and standards as outlined in the document "Commercial Standards CS45-38." A résumé of the mandatory FHA provisions follows:

"Thickness not less than 3/8 inch. Edges primed before erection. Nailed with 6d flat head nails spaced not over 6 inches o/c along edges and 12 inches on intermediate bearings. Butt edges filled with mastic or covered by battens. The FHA requirements do not allow for the increased bracing and vertical strength gained from the use of plywood." (With more experience records it is to be expected that the requirements will be revised to permit lighter frames.)

With ordinary wood frame construction, the frame itself must be considered the sole source of strength for vertical loads. The only structural function performed by ordinary sheathing and interior finish is to provide for lateral bracing and even here the frame must take care of a good percentage of the required bracing strength. As for ordinary siding, it is perfectly obvious that its only functions are to provide a decorative surface and to exclude wind and weather. In usual wood construction, the exterior and interior covering may be said to serve as the

THE PHOTOGRAPH ABOVE SHOWS STRIPS OF PLYWOOD (FURSTIX) NAILED TO THE STUDDING. THE STRIPS ARE COATED WITH CASEIN GLUE AND THE PLYWOOD PANELS ARE THEN DRAWN UP TIGHTLY AND NAILED TO THE STRIPS. THE CRACK IS FILLED WITH PLASTIC WOOD OR SWEDISH PUTTY AND THE CONTINUOUSLY FLUSH WALLS OR CEILINGS ARE THEN READY FOR DECORATION. THE DRAWING BELOW SHOWS HOW A 4-FOOT MODULE FOR STANDARD WIDTH PLYWOOD CAN BE MADE TO APPLY TO BOTH INTERIOR AND EXTERIOR BY MEANS OF CORNER BOARDS



CORNER DETAIL

skin of the building, having no strength. In plywood structural systems, however, exterior and interior perform the function of muscle as well as skin, thus permitting the use of a much lighter skeleton, or frame. For the first time in the history of building we are approaching the efficiency which is taken for granted in the realm of natural law where the principle of the stressed skin is an essential element of the structure of all living organisms.

In this manner the strength of plywood is put to work and at the same time the full value of the natural beauty of wood is utilized to provide an excellent finish for the interior and exterior. While many materials are being developed which satisfy one or the other of these conditions, plywood can claim excellence for both purposes.

The perpetual argument about the relative merits of prefabrication or non-prefabrication, standardization or variation will become less significant when all houses are made of fewer parts. Whether prefabricated or site-fabricated, every one can agree that it is advantageous to construct out of larger and therefore fewer units. If plywood is substituted for ordinary sheathing and subflooring in a small house, between four and five hundred pieces of material are reduced to sixty to seventy. When the outside covering of a small house can be made out of twenty to thirty pieces which can be applied in one-half day by three men, there is less urgency to construct them in factories in order to save labor time.

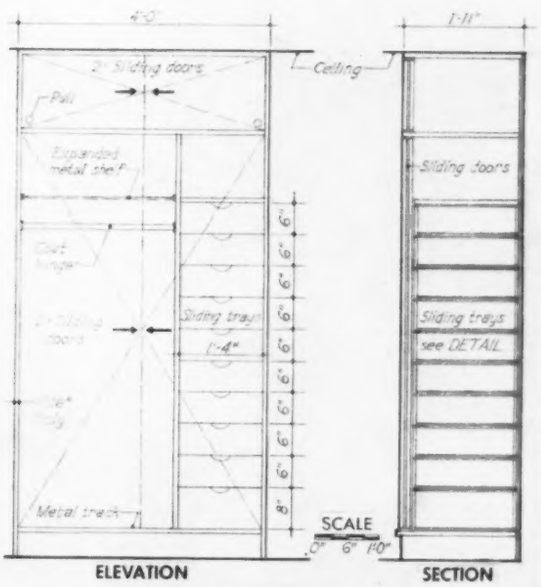
There have been sufficient tests to prove conclusively that the material itself will stand the stress of time. Much water has gone over the dam, floods and hurricanes have ravaged the country since the first plywood houses were constructed, many of them taking the brunt of the destructive waters and winds. In spite of the fact that many of the structural systems employed were experimental and required revision, nothing essential has been found lacking in the material. There have been a variety of systems of construction with plywood developed, no one of which can be claimed as the only way to build with plywood.

The author has developed a system of construction which can serve to indicate the elements to be considered in designing with this new material. The method was developed to utilize plywood most advantageously; its strength and simplicity of surface and to take complete advantage of its labor saving possibilities. There is nothing revolutionary about the framing method except that it dates back to Revolutionary times. The frame is built of 4″ x 4″s 4′-0″ o/c with horizontal 2″ x 4″ girts also 4′-0″ o/c entirely around the building. By acting as a stressed skin the interior and exterior plywoods contribute their share to help support the vertical loads although the 4″ x 4″s may be considered adequate for this purpose. The 2″ x 4″ girts provide lateral bracing and nailing for the horizontally applied exterior plywood. However, here too the stressed plywood provides far more lateral bracing than is common when ordinary sheathing and diagonal bracing is used. In fact, ¼″ plywood sheathing makes a frame wall 40 percent more rigid than one diagonally sheathed or with let-in braces; nearly four times as rigid as cut-in bracing; and nearly six times as rigid as horizontal sheathing. While engineering tests have not yet been made on the system described, it is reasonable to assume that with the use of ½″ 5-ply exterior plywood the strength and rigidity of the structure is far superior to any other ordinary method of construction.

The advantages of the 4″ x 4″ frame are mainly labor-saving as fewer framing members need to be cut and set. In addition, the 4″ x 4″s afford a wider surface to allow for tolerance of errors or inaccuracies in framing. A number of small houses built by the author and employing this system have been framed in less than normal time and the exterior was completely covered by three men in one-half day. The total cost of the exterior and interior plywood, erected, did not exceed the usual cost of plastering the interior alone.

The advantage of having one joint where there were formerly eight is obvious when weatherproofing and insulation are consid-

THE ILLUSTRATION SHOWS THE USE OF PLYWOOD FOR CABINET WORK AS DESIGNED BY ARCHITECT A. LAWRENCE KOCHER. ABSOLUTELY FLUSH CONSTRUCTION OF ALL PARTS IS BOTH FUNCTIONAL AND IN KEEPING WITH THE MODERN TREND. DRAWERS WHICH ARE CAREFULLY MADE WITH SIDES OF 5-PLY AND BOTTOMS OF 3-PLY, ACCURATELY CUT, GLUED AND JOINED, WILL STAY RECTANGULAR AND WILL ELIMINATE THE NEED FOR CENTER GUIDES. CENTER GUIDES HAVE HITHERTO BEEN REGARDED AS A LUXURY AVAILABLE ONLY IN EXPENSIVE WORK



ELEVATION SECTION

ered. There are a number of ways to take care of the few remaining joints. Those illustrated utilize the horizontal ship-lap and the vertical calked joints. These permit the maximum amount of movement and insures a perfect seal without any risk of buckling. A number of houses have been built with this system in New England where the variable climate has put it to a severe test. The hurricane of 1938 which severely damaged nearby structures left these houses unaffected. The experience gained in the laboratory of the great outdoors has proved the correctness of the engineering principles embodied in this new plywood and the methods of construction.

An exciting field for interesting exploration is still open to those with imagination who desire to contribute to the inevitable progress in shelter design. Other structural systems developed by the following should be studied by the designer as a starting point for his efforts:

Forest Products Laboratory, Madison, Wis.
Douglas Fir Plywood Association, Tacoma
John B. Pierce Foundation, New York
Resettlement Administration, Washington
Tennessee Valley Authority, Washington
David Swope, Ossining, N. Y.
E. A. Horn, Seattle, Washington
Frank Watson, Purdue University
W. F. Ruck & Zara Witkin, Los Angeles
John B. Lyman & Russell E. Collins, Los Angeles
W. W. Durham, Tacoma
Michael Goodman, Berkeley, California

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